Crusader®

OWNER'S OPERATION

and

MAINTENANCE MANUAL

A Division of PLEASURECRAFT® ENGINE GROUP

Welcome to the growing family of Crusader Marine Engines owners. We are delighted you have chosen Crusader power for your boat and wish you many years of enjoyment.

When you chose Crusader, you selected the utmost in premium power for your boating application. Crusader is the world's largest manufacturer of gasoline marine inboards, and the clear-cut leader in cutting edge technology. Over the years, Pleasurecraft Engine Group, through Crusader and PCM, has introduced many breakthrough innovations that quickly became industry standards. The pyramidal exhaust system, light-weight transmissions, computerized engine control, micro adjustable all stainless steel mounts, and the Fuel Control Cell (FCC) are all Pleasurecraft innovations. No matter which Crusader model you purchased, you can be sure it is equipped with the latest in modern technology for added performance and durability.

READ THIS MANUAL THOROUGHLY

Before starting your engine(s), READ THIS MANUAL CAREFULLY AND COMPLETELY. If you do not understand any portion of the manual, contact your Dealer for clarification or assistance. Ask your Dealer for a demonstration of actual starting and operating procedures.

The descriptions and specifications contained in this manual were in effect at the time of printing. Crusader Marine Engines' policy of continued improvement reserves the right to change specifications or design without notice and without obligation.

This manual will cover the following year of manufacture Crusader engines:

Year	Model
2009	**5.0L MPI**
2009	**5.7L MPI**
2009	**6.0L MPI**
2009	**8.1L MPI**
2009	**8.1L MPI (HO)**

Part Number - L510001-09 Printed 12/08

PROPOSITION 65

⚠ WARNING
The engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects or other reproductive harm.

TABLE OF CONTENTS

TABLE OF CONTENTS

SAFETY INFORMATION

"Safety Warnings" and additional information or instructions are used to alert the installer/operator of possible safety hazards in performing certain service or maintenance procedures incorrectly or carelessly. DANGERS and WARNINGS are accompanied by the international HAZARD symbol: ⚠

These "Safety Warnings" alone cannot eliminate the hazards that they signal. Strict compliance with these warning instructions while performing service and maintenance procedures, plus "common sense" operation, are major accident prevention measures.

REPLACEMENT PARTS

⚠ DANGER
Electrical, ignition and fuel system components are designed and manufactured to comply with U.S. Coast Guard rules and regulations to minimize the possibility of fire or explosion hazard.

Use of replacement parts (i.e. automotive, after-market, etc.) in the electrical, ignition and fuel systems, which are not U.S. Coast Guard approved, could cause a fire or explosion hazard and should be avoided.

Always request that genuine Crusader Marine Engines replacement parts be used in any repairs or maintenance being performed on your engine(s).

SAFETY WARNINGS

⚠ DANGER
Signals serious damage, failure or breakdown of equipment; severe injury or high probability of death to the user if proper precautions are not taken. This signal word is applied in extreme situations

⚠ WARNING
Indicates a potential hazard which could result in personal injury.

⚠ CAUTION
Indicates a hazard which could result in damage to equipment.

IMPORTANT: or ***IMPORTANT:*** Used to provide information to perform a procedure more easily.

WARRANTY NOTICE: Indicates a possible warranty exclusion.

OWNER'S SERVICE
AND
WARRANTY INFORMATION

CRUSADER MARINE ENGINES' COMMITMENT TO YOU

Crusader Marine Engines is committed to assuring your satisfaction with your new Crusader engine. Your Dealer also wants you to be completely satisfied, and invites you to return for all your servicing needs, both during and after the warranty period.

OWNER WARRANTY REGISTRATION

It is important that your selling dealer fill out the "Warranty Registration Card" completely and mail it to the factory immediately upon the purchase of the new product. It identifies the name and address of the original purchaser, product model(s) and serial number(s), and the selling dealer's name and address. The dealer is also certifying that you are the original purchaser of the product.

Upon receipt of the "Warranty Registration Card" at the factory, you will be issued an "Owner Warranty Registration Card." The "Owner Registration Card" is your only valid registration identification, and must be presented to the servicing dealer, should warranty service be required.

If your "Owner Registration Card" is not received within 30 days from the date of purchase, please contact your boat dealer or engine seller. The product warranty is not effective until the Product is registered at the factory.

Mail registration information to:

Crusader Marine Engines
P.O. Drawer 369
Little Mountain, SC 29075

NOTE: OWNERS WARRANTY REGISTRATION CARD IS LOCATED AT THE BACK OF THIS MANUAL.

NOTICE: Registration lists must be maintained by the factory and dealer on marine products sold in the United States and some foreign countries, should notification under **FEDERAL BOAT SAFETY ACT** be required. It is our desire to have all products registered at the factory, should it ever be necessary to contact you. Make sure your Dealer/Distributor fills out the registration card immediately and sends the card to the factory.

ENGINE OPERATION AND CARE

Considering the investment that you have made in your new Crusader engine(s), we know you will want to operate and maintain it properly. We urge you to follow the maintenance instructions contained in your engine's "Operation and Maintenance Manual."

If you have any questions on how to keep your engine in good working condition, see your selling dealer, the place where many owners choose to have their maintenance work done. Your Crusader Premier dealer can be relied on to use proper parts and practices.

MAINTENANCE RECORDS

It is recommended that receipts covering the performance of regular maintenance be retained. Damage to your engine, caused by lack of maintenance, is not covered under your warranty. Receipts can be very important if a question arises as to whether a malfunction is caused by lack of maintenance or a defect in material or workmanship. An "Engine Maintenance Log" is provided in the MAINTENANCE SCHEDULE section of the OPERATION AND MAINTENANCE MANUAL for your convenience in recording the service performed.

LOCAL REPAIR SERVICE

To obtain service or make a claim under your warranty, contact your selling dealer. They have trained technicians, knowledge and special tools and equipment to properly service your engine, if the need arises. They know you and your boat the best.

SERVICE AWAY FROM HOME

If you are away from home and your local dealer, and the need for service arises, contact the Crusader Captain's Club™ Concierge using your exclusive Captain's Club toll-free number. The Club Concierge is there to support your local dealer or locate the closest Crusader authorized technician. She can personally expedite parts orders so that in most cases, shipment is made within 24 hours, delivered on time to the location you specify.

REPLACEMENT PART INQUIRIES

All inquiries concerning replacement parts should be directed to your local authorized Crusader Premier dealer. The dealer has the necessary information to order parts for you if they are not in stock. Only authorized distributors can purchase parts from the factory. Crusader Marine Engines does not sell to unauthorized dealers or retail customers. When checking on parts, the dealer will require the engine model and serial number to order the correct parts.

REPLACEMENT SERVICE PARTS

WARNING
Electrical, ignition and fuel system components on Crusader engines are designed and manufactured to comply with U.S. Coast Guard rules and regulations to minimize the risks of fire or explosion. Use of replacement electrical, ignition or fuel system components, which do not comply with these rules and regulations, could result in a fire or explosion hazard and should be avoided.

When servicing the electrical, ignition and fuel systems, it is extremely important that all the components are properly installed and tightened. If not, any electrical or ignition component opening would permit sparks to ignite fuel vapors from fuel system leaks, if they existed.

APPLICABLE LIMITED WARRANTY

Following is the limited warranty applicable to Crusader Marine Engines sold and used in the United States and Canada.

Distributors and Dealers are not agents of Crusader. Crusader does not authorize any person to create any other obligation or liability in connection with this product.

CRUSADER, INC. INBOARD MARINE ENGINES
TWO YEAR LIMITED WARRANTY
(For Engines Sold and Used in the United States and Canada Only)

1. Crusader, Inc. (Hereinafter referred to as "Crusader") warrants each of its new inboard marine engines and accessories attached thereto ("Products"), to be free from defects in material and workmanship for a period of two (2) year, except to the extent limited herein. This Limited Warranty commences on the day of the first retail sale and/or the first date used, and extends to the original and subsequent retail sales; however, in no event shall the duration of the Limited Warranty exceed two (2) year, as measured from the original retail sale date.
2. Under this Limited Warranty, Crusader's obligation is limited to repairing or replacing those parts of Products that have become defective within the applicable warranty period, because of defective materials or workmanship. Crusader will arrange for the correction of all defects under this Limited Warranty to be made free of charge at the selling dealership or an authorized Crusader service center. Crusader, in its discretion, may provide for the repair or replacement of any defective part at Crusader's facility. Crusader will make payment for labor to replace such parts as provided in the, then, current flat rate labor manual or Warranty Procedures Manual.
3. This Limited Warranty does not apply to Product defects caused by normal wear and tear to Products, and/or damage to Products arising out of negligence or lack of proper care, improper installation or service, operation with fuels, oils or lubricants which are not suitable for use with Products, alterations or removal of parts, water entering an engine through the exhaust system or carburetor, installation of accessories or parts not manufactured or sold by Crusader, or Products rendered defective by accident.
4. If a part should become defective within the applicable warranty period, advance authorization by Crusader is necessary before the part is replaced or a defect is corrected by a service representative; otherwise Crusader will not be liable for the expense of the replacement or correction.
5. Replacement parts and accessories supplied by Crusader, and installed on a Product during the period when the Product is covered under the provisions of this Limited Warranty, are warranted for the unexpired portion of the existing warranty period, or ninety (90) days from the date of installation of such new parts or accessories, whichever is longer.
6. Reasonable access to the Product must be provided for warranty service. This Limited Warranty does not cover: (1) telephone or telegram charges, towing charges, storage, launch and haul out charges, loss or damage to personal property, loss of revenue, loss of time, travel, lodging, inconveniences or other CONSEQUENTIAL DAMAGES, or (2) removal and/or replacement of boat partitions or material, because of boat design, for necessary access to the Product.

7. **NO OTHER WARRANTY GIVEN**

THE OBLIGATIONS SET FORTH IN THE PRECEDING PARAGRAPHS ARE CRUSADER'S SOLE OBLIGATIONS AND OWNER/USER'S EXCLUSIVE REMEDY. CRUSADER MAKES NO OTHER WARRANTY, EXPRESS OR IMPLIED (except to the extent provided in the immediately following paragraph), AND MAKES NO WARRANTY OF MERCHANTABILITY OR FITNESS FOR PARTICULAR PURPOSE.

However, to the extent that any warranty may be implied by law, the term of such implied warranty shall be limited to a period of time corresponding to the period of express warranty applicable to the particular Product, and its use by the owner/user, as set forth herein, commencing on the date of the first retail sale of the Product to the first registered owner or registered user. Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you.

This is sole warranty provided respecting Crusader's Products, and no other party may make a warranty to owner/user.

CRUSADER SHALL NOT BE LIABLE FOR ANY LOSS OF TIME, INCONVENIENCE, COMMERCIAL LOSS OR DIRECT OR INDIRECT, INCIDENTAL (except as specifically provided herein) OR CONSEQUENTIAL DAMAGES. Some state do not allow the exclusion or limitation of incidental or consequential damages, so this limitation or exclusion may not apply to you. This Warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Any owner/user hereby waives for himself/herself/itself and his/her/its successors and assigns (a) any and all claims for punitive damages, and (b) all claims of negligence or strict liability or both. In no event will Crusader's liability exceed the purchase price of the Products which is actually paid to Crusader.

8. To make a claim under this Limited Warranty, contact the selling dealer from which your Crusader powered boat was originally purchased or the nearest authorized Crusader servicing dealer. It is recommended that your warranty service be performed by the dealer which sold the Product to you because of that dealer's personal interest in you as a customer. Your Crusader powered Product must be delivered to the servicing dealer within the applicable warranty period. Proof of purchase may be required by the Crusader dealer to substantiate any warranty claim. Use your Crusader Owner Warranty Registration Card to establish proof of purchase.

9. ITEMS NOT COVERED UNDER LIMITED WARRANTY

This Limited Warranty is limited to defects in material and workmanship. To avoid misunderstandings regarding warranty coverage, the following describes some, but not all, of the more common types of service that are not covered by this Limited Warranty.

- Normal service requirements arising during the warranty period, such as fuel system or ignition adjustments, tune-ups, filter, adjusting controls or lubrications.
- Damage caused by neglect, lack of maintenance, abnormal operation accident or improper installation or service.
- Normal wear of the piston rings, cylinders, water pump and other engine parts.
- Haul out, launching, towing charges, dockage or storage fees, removal and/or replacement of boat partitions or material, because of boat design, for necessary access to the product.
- All related transportation charges and/or travel time.
- The cost of shipping replacement parts by air freight or other premium freight methods.
- Additional service work requested by the customer or performed by the dealer other than that necessary to satisfy the warranty obligation.
- Labor performed by other than an authorized dealer may be covered only under the following circumstances: when performed on an emergency basis (providing there are no authorized dealers in the area who can perform the work required, and prior factory approval has been given to have the work performed at this facility).
- Damage from participating in, or preparing for, racing or other competitive activity.
- Water entering the engine cylinders or oiling system through the intake manifold system, exhaust system, submersion, or in any manner if not caused by a Crusader manufacturing defect.
- Water in starters.
- Improper winterizing resulting in freezing and breaking of the engine block, cylinder heads, exhaust manifolds, heat exchanger or other damage.
- Repairs made necessary by normal wear, rust, electrolysis or corrosion, or by the use of the parts or accessories which are either incompatible with the Crusader product or adversely affect its operation, performance or durability.
- Valve or valve seat grinding required because of wear.
- Failure or damage due to lack of cooling water caused by starting the Product out of the water or by foreign material blocking the water inlets.
- Cleaning of the engine fuel system due to water or dirt contamination of the boat fuel system.
- Use of fuel and lubricants which are not suitable for use with or on the Product. Refer to the Operation and Maintenance Manual.
- Damage to the engine and/or transmission caused by striking a submerged object. (This is considered a marine hazard).

10. This Limited Warranty shall be governed by, and construed and interpreted in accordance with, the laws of the State of Ohio, without application of its conflicts of laws principles, except only to the extent replaced or precluded by other law of mandatory application.

11. SPECIAL STATE LEGAL REQUIREMENTS

This Warranty gives you specific legal rights, and you may also have other rights which vary from State to State.

The Crusader California Emissions Warranty and California Emission Control Warranty Statement is a separate document included in this Manual. Any questions concerning the Emissions Warranty can be obtained by calling 1-803-345-0050.

THINGS YOU SHOULD KNOW ABOUT THE WARRANTY

Warranty Repair Component Exchanges

In the interest of customer satisfaction, Crusader Marine Engines may offer an exchange service on some engine components. This service is intended to reduce the amount of time that your boat is not available for use, due to repairs. Components used for the exchange service may be new, remanufactured, reconditioned or repaired, depending upon the component involved. All exchange components used meet Crusader standards and are warranted the same as new components.

Production Changes

Crusader Marine Engines and its Distributors reserve the right to make changes in the engines built and/or sold by it at any time without incurring any obligation to make the same or similar changes on engines previously built and/or sold.

Proof of Date of Purchase

Crusader will accept the return of a properly filled out “Warranty Registration Card”, supplied with each engine, as proof of purchase. Failure of purchaser to return such card will require the owner to provide a copy of the original “Bill of Sale” (sales contract) for the Product to be serviced. Warranty claims will not be accepted until adequate “Proof of Purchase” is presented by the purchaser, and the date of purchase is substantiated.

Access to Product

Reasonable access must be provided to the Product for warranty service. The warranty does not cover the removal and/or replacement of boat partitions and/or other components which must be removed for necessary access to the Product.

CALIFORNIA EMISSION CONTROL WARRANTY STATEMENT
YOUR WARRANTY RIGHTS AND OBLIGATIONS

The California Air Resources Board and Crusader, Inc. (hereinafter "Crusader") are pleased to explain the emission control system warranty on your inboard marine engine manufactured after January 1, 2008. In California, new inboard engines must be designed, built and equipped to meet the State's stringent anti-smog standards. Crusader must warrant the emission control system on your inboard engine for the periods of time listed below provided there has been no abuse, neglect or improper maintenance of your inboard engine.

Your emission control system may include parts such as the carburetor or fuel injection system, the ignition system, and catalytic converter. Also included may be hoses, belts, connectors and other emission-related assemblies.

Where a warrantable condition exists, Crusader will repair your inboard engine at no cost to you, including diagnosis, parts and labor.

MANUFACTURER'S WARRANTY COVERAGE:

Select emission control parts from inboard marine engines manufactured after January 1, 2008 are warranted for 3 years or 480 hours, whichever first occurs.

However, warranty coverage based on the hourly period is only permitted for engines that are equipped with appropriate hour meters as defined in § 2441(a)(13) or their equivalent. If any emission related part on your engine is defective under warranty, the part will be repaired or replaced by Crusader.

OWNER'S WARRANTY RESPONSIBILITIES:

– As the inboard engine owner, you are responsible for the performance of the required maintenance listed in your owner's manual. Crusader recommends that you retain all receipts covering maintenance on your inboard engine, but Crusader cannot deny warranty solely for the lack of receipts or your failure to ensure the performance of all scheduled maintenance.

– As the inboard engine owner, you should however be aware that Crusader may deny you warranty coverage if your inboard engine or a part has failed due to abuse, neglect, improper maintenance or unapproved modifications.

– You are responsible for presenting your inboard engine to an authorized Crusader dealer as soon as a problem exists. The warranty repairs will be completed in a reasonable amount of time, not to exceed 30 days.

If you have any questions regarding your warranty rights and responsibilities, you should contact Crusader at 1-803-345-0050.

CRUSADER, INC. GENERAL EMISSIONS WARRANTY COVERAGE
(Engines Manufactured after January 1, 2008)

1. Crusader, Inc.. (hereinafter referred to as "Crusader") warrants to the first owner purchasing at retail, and all subsequent owners, of every Crusader inboard marine engine manufactured after January 1, 2008, that the emissions control devices on Crusader inboard marine engines are free from defects in materials and workmanship when manufactured and will remain so for a period of three (3) years or 480 hours, whichever first occurs, from the date of delivery to the first owner purchasing the engine at retail or from the date the engine is first placed into service for demonstration or any other purpose prior to sale to the first owner purchasing the engine at retail.

2. Pursuant to the California Code of Regulations Title 13, Chapter 9, Article 4.7§ 2445.1, Crusader warrants that each Crusader engine is designed, built and equipped to conform with all applicable regulations adopted by the California Air Resources Board pursuant to its authority in Chapters 1 and 2, Part 5, Division 26 of the Health and Safety Code, and is free from defects in materials and workmanship that cause the failure of a warranted part to be identical in all material respects to that part as described in Crusader's application for certification.

3. Any part covered under this Warranty that is not scheduled for replacement as required maintenance, in the written instructions to be found within the Crusader Owners/Operators Manual, is warranted for the period of three (3) years or 480 hours, whichever first occurs. If the part fails during the period of warranty coverage, Crusader will repair or replace the defective part at any Crusader warranty station. The repair or replacement will be performed at no charge to the owner. Any such part repaired or replaced under this Warranty will be warranted for the remainder of the three (3) year or 480 hours, whichever first occurs, period.

4. Any part covered under this Warranty that is scheduled only for regular inspection in the written instructions to be found within the Crusader Owners/Operators Manual, is warranted for the period of three (3) years or 480 hours, whichever first occurs. If the part fails during the period of warranty coverage, Crusader will repair or replace the defective part at any Crusader warranty station. The repair or replacement will be performed at no charge to the owner. Any such part repaired or replaced under this Warranty will be warranted for the remainder of the three (3) year or 480 hours, whichever first occurs, period.

5. Any part covered under this Warranty that is scheduled for replacement as required maintenance in the written instructions to be found within the Crusader Owners/Operators Manual will be warranted for the period of time before the first scheduled replacement date for that part. If the part fails before the first scheduled replacement, Crusader will repair or replace the defective part at any Crusader warranty station. The repair or replacement will be performed at no charge to the owner. Any such part repaired or replaced under this Warranty will be warranted for the remainder of the period prior to the first scheduled replacement date for the part.

6. Replacement of any part under this Warranty with a Crusader supplied part, will not shorten nor extend the warranty period(s) stated in paragraphs one (1) thru four (4) above.

7. The engine owner will not be charged for diagnostic labor that is directly associated with diagnosis of a defective, emission-related warranted part, provided that such diagnostic work is performed at a Crusader warranty station.

8. To insure prompt repair under this Warranty, Crusader will maintain a supply of warranted parts sufficient to meet the expected demand for such parts. Any replacement part may be used in the performance of any warranty maintenance or repairs and will be provided by Crusader without charge to the owner.

9. Parts covered under this Warranty are:

1. Fuel Metering System
   - A. Fuel Injectors
   - B. Fuel Pressure Regulator
   - C. Manifold Absolute Pressure Sensor
   - D. Throttle Position Sensor
   - E. Throttle Body - Port Fuel Injection Models
   - F. Coolant Temperature Sensor
   - G. Intake Valves
   - H. Oxygen Sensors
2. Air Induction System
   - A. Intake Manifold
   - B. Air Filter (Flame Arrestor)
3. Ignition System
   - A. Spark Plugs
   - B. Electronic Ignition System
   - C. Ignition Coil and/or Control Module
   - D. Ignition Wires
4. Lubrication System
   - A. Oil Pump and Internal Parts
5. Positive Crankcase Ventilation (PVC) System
   - A. PCV Valve
   - B. Oil Filler Cap
6. Exhaust System
   - A. Exhaust Manifold(s)
   - B. Exhaust Riser(s)
   - C. Exhaust Valves
   - D. Catalytic Converters
7. Miscellaneous Items Used on Above Systems
   - A. Hoses, clamps, fittings, tubing, sealing gaskets or devices and mounting hardware
   - B. Electronic Controls
   - C. Electronic Control Module
   - D. Pulleys, belts and idlers

10. Exclusions: The repair or replacement of any warranted part otherwise eligible for coverage under this Warranty may be excluded from such warranty coverage if Crusader demonstrates that the engine and/or part has been abused, neglected, or improperly maintained, and that such abuse, neglect, or improper maintenance was the direct cause of the need for repair or replacement of the part.

11. Crusader original equipment parts are "identical in all material respects to that part as described in the engine manufacturer's application for certification". The use of any replacement parts not supplied by Crusader may not meet this requirement and will be grounds for disallowing a claim made under this Warranty. Crusader will not be liable under this Warranty or provide warranty coverage for product failures caused by parts other than Crusader original equipment parts.

12. If you have any questions regarding your warranty rights and responsibilities, or the location of Crusader warranty stations near you, you should contact Crusader at 1-803-345-0050.

MARINE TRANSMISSIONS

Crusader Marine Engines are equipped with transmissions designed, built and warranted by other manufacturers. Although much of the transmission warranty is handled through Crusader Marine Engines, there may be issues for which, you, the owner, may want to contact the transmission manufacturer directly. The transmission suppliers are listed below for your reference. A tag is attached to each transmission showing the manufacturer, transmission model and serial number. Have this tag information available whenever contacting the manufacturer.

Velvet Drive Transmissions
1208 Old Norris Road
P.O. Box 238
Liberty, SC 29657
Phone: (864) 843-9234
www.velvetdrive.com

ZF Marine - Hurth Marine Transmissions
3131 SW 42nd Street
Ft. Lauderdale, FL 33312
Phone: (954) 581-4040

RESOLVING A SERVICE PROBLEM

Your satisfaction and faith in the product are of major importance to your dealer and to Crusader Marine Engines. Any problems with service, warranty or operation of your Crusader powered boat will be resolved by your dealer. He should be your primary source of information on your boat. Should there be a misunderstanding, or if your problem has not been resolved to your satisfaction, please follow these steps:

Step One - Discuss Your Problem With One Of The Dealership Management Personnel

Misunderstanding or complaints can be resolved quickly by the dealer. Discuss your problem with the dealership's service manager. If you are still unable to obtain satisfaction, contact the dealership's owner.

Step Two - If Your Complaint Has Not Been Resolved To Your Satisfaction, Contact The Crusader Captain's Club™ Concierge

When contacting the Club Concierge:

- Call the confidential toll free number you received with your Captain's Club™ membership between 8:00 a.m. and 5:00 p.m. EST, Monday through Friday.
- Have your Captain's Club™ membership card available, so you can provide the Club Concierge with your PIN.
- Details of your problem or complaint

Your Crusader engine warranty and Captain's Club™ membership are activated when your dealer sends in the warranty registration cards for your engine(s). You will receive your Crusader Captain's Club™ membership package after Crusader receives the warranty registration card(s). If you have not received your Club membership, follow up with your dealer to ensure that your engine(s) warranty registration has been filed.

DEALERS RESPONSIBILITIES

In general, the dealer's responsibilities to you, the customer, include pre-delivery inspection and preparation such as:

- Make sure that the boat is properly equipped
- Prior to delivery, make certain that the Crusader Engine is in proper operating condition
- Make all necessary adjustments for maximum efficiency
- Familiarize you, the owner, with the on-board equipment
- Explain and demonstrate the operation of the engine, and also the boat
- Explain warranty policies and deliver all operating manuals for the engine and the boat
- Complete the owner's warranty registration card and return it to the factory

TRANSFERABLE WARRANTY

The product limited warranty is transferable to a subsequent purchaser, but only for the remainder of the unused portion of the limited warranty. This will not apply to the products used for commercial applications.

DIRECT SALE BY OWNER

The second owner can be registered as the new owner, and may retain the unused portion of the limited warranty.
The forms and instructions necessary to transfer the unused portion of the Crusader Two Year Limited Warranty are provided in Forms, section 18 of this manual.

Upon receipt of the transfer application a new “Owner Warranty Registration Card” will be issued with the new owner’s name and address. Registration records will be changed on the factory computer registration file.

CARBON MONOXIDE HAZARD

> ⚠ **DANGER**
>
> **Carbon Monoxide (CO) is a colorless, odorless and tasteless gas. You cannot see it, smell it or taste it. Prolonged exposure to carbon monoxide can lead to unconsciousness, brain damage or death!**

Carbon monoxide is produced when anything that contains carbon, such as gasoline, natural gas, oil, propane, coal or wood is burned. Carbon monoxide is commonly found in the exhaust of internal combustion engines (boat power plants, generators, etc.). In addition, open flame devices like cooking ranges, heaters and charcoal grills also produce carbon monoxide.

Carbon monoxide accumulation, in and around boats is affected by vessel geometry; overall vessel design; closeness to other structures; wind direction; boat speed; and many other variables. In no way can this section cover all of the possible variables. Do not rely on this section as the exclusive listing of measures to prevent the accumulation of carbon monoxide.

Consult your boat operators manual for detailed information on the inspection and/or maintenance of the exhaust system for your particular application. If an inspection reveals possible leaks, DO NOT operate your engine(s) until it can be serviced by a qualified technician.

Proper and adequate air circulation, around and throughout the boat, is absolutely necessary to aid in the prevention of carbon monoxide build-up. If you have any questions or concerns regarding the operation of your boat and carbon monoxide hazards, DO NOT operate your engines until you have contacted your boat manufacturer.

To find out more about making boating safer, including how you can prevent carbon monoxide poisoning on recreational boats, contact:

National Marine Manufacturers Association
200 East Randolph Drive
Suite 5100
Chicago, IL 60601-6528
www.nmma.org
312-946-6200

United States Coast Guard
Office of Boating Safety
CG Headquarters G-OPB-3
2100 Second Street SW
Washington, DC 20593
www.uscgboating.org
202-267-0984

American Boat & Yacht Council, Inc.
3069 Solomon’s Island Road
Edgewater, MD 21037-1416
www.abyc.com
410-956-1050

SAFE BOATING SUGGESTIONS

The nation's waterways are becoming increasingly crowded and, in order to enjoy them safely, the operator should acquaint himself/herself with safe boating practices. Boating safely and seamanship courses are offered by the following national and state organizations:

- Power Squadrons
- Coast Guard Auxiliary
- Red Cross
- State, provincial or local agencies in charge of water safety enforcement

Crusader Marine Engines highly recommends that all power boat operators attend one of these courses. To help locate a course being offered near you, contact Boat U.S. Foundation's toll-free national boating safety hotline, 1-800-336-BOAT, and in Virginia, 1-800-245-BOAT.

WATER WISDOM

The following are suggestions for safe operation of your boat to ensure the safety of yourself and your passengers:

- Know your boat's loading and operating limitations. DO NOT OVERLOAD!
- Make periodic checks of safety equipment onboard.
- Do not consume alcoholic beverages or take illegal drugs when operating a boat. Some state laws apply to boats as well as motor vehicles.
- File a "float plan." Let someone know your destination and your expected time of return.
- Monitor the weather. Know the signs of weather change and avoid severe weather and rough seas whenever possible.
- Follow the "Rules of the Road" when boating. Always be on the alert and watch out for "the other guy."
- Plan and chart your course. Be aware of, and avoid, hazardous areas.
- Be sure your boat is equipped with the required safety equipment. Check with the Coast Guard and local government agencies as to the regulations and restrictions in your area. Contact your local Coast Guard Auxiliary and take advantage of their seasonal boat inspections.

The following is a list of suggested safety equipment and spare parts which may be useful in case of an emergency:

- Approved personal flotation devices (life jackets); one for each person on board.
- Approved throwable personal flotation device for man-overboard protection.
- Approved fire extinguishers
- Signal devices: flares, spotlight, signal flag and horn or whistle
- Crusader Marine Engines' "Onboard Kit," plus spare fuses, bulbs, batteries, etc. Tools necessary for minor repairs
- Spare propeller
- Anchor and anchor line
- First aid kit and first aid book
- Ship-to-shore radio, compass and chart of the area in which you are traveling
- Manual bilge pump and spare drain plugs
- Waterproof storage containers

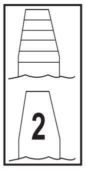
OPERATION AND MAINTENANCE

It is the owner's/operator's responsibility to perform all safety checks before operating his/her boat. All lubrication and maintenance schedules must be adhered to assure optimum performance and dependability from your Crusader engine. When service and maintenance are required, return to your authorized Crusader Marine Engines Dealer.

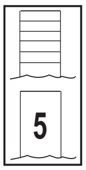
RULES OF THE ROAD

Channel Buoy Guide

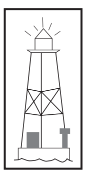
The color of the paint is the only characteristic which has the same meaning on all buoys. Red buoys always indicate the starboard side of the channel from seaward. (Red Right Returning)



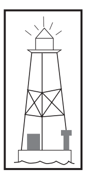
1. **Nun Buoy:** This buoy indicates the starboard side of the channel when returning from sea. It is conical shape, the color red and indicates even numbers. A nun buoy with red and green horizontal bands (top band red), and not numbered, indicates an obstruction. The principal channel is to the left of the buoy when returning from sea.



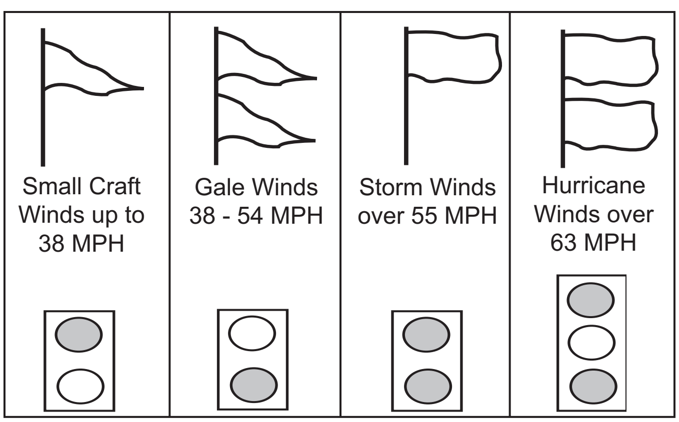
2. **Can Buoy:** This buoy indicates the port side of the channel when returning from sea. It is cylindrical shape, the color green and indicates odd numbers. A can buoy with green and red horizontal bands (top band green), and not numbered, indicates an obstruction. The principal channel is to the right of the buoy when returning from sea.



3. **Lighted Buoy (RED):** This buoy has a flashing red light. It indicates the starboard side of the channel when returning from sea.



4. **Lighted Buoy (GREEN):** This buoy has a quick flashing green light. It indicates the port side of the channel when returning from sea. The quick flashing light indicates special caution required.



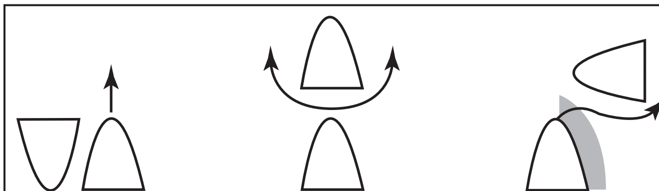
Storm Warning Signals - Pennants (by day)
Lights (by night)

Boat Capacity

- Load only to manufacturer's specifications
- Distribute load evenly; keep it low
- Passengers should only ride on the parts of the boat that are designed for that purpose
- If water is rough, carry fewer passengers

Observe the Rules of the Road

PORT (Left) - Leaving the harbor with green buoys to your right.
STARBOARD (Right) - Entering the harbor with red buoys to your right.



Keep to Right in narrow channels. **Boat being overtaken has right of way. Overtaking boat must stay clear.** **Yield to boats approaching in this area.**

Know Your Horn Signals

1 Short Blast = Passing you on my port side
2 Short Blasts = Passing you on my starboard side
3 Short Blasts = I am going astern
5 Short Blasts = Danger
Always refer to the latest U.S. Coast Guard Navigation Rules CG-169.

Keep An Alert Lookout For:

Bad weather, Swimmers, Other boats, Water skiers, Fisherman, Divers and/or any other obstructions

Keep Your Wake Under Control, particularly upon entering or leaving harbor areas. You are responsible for wake damage to other vessels and/or property.

Do Not Fool With Fuel

1/2 pint of gasoline = 15 sticks of dynamite

1. During fueling, moor boat properly; remove all passengers.
2. Keep all doors, hatches and ports closed.
3. Shut down all electronic gear; extinguish galley fires, pilot lights and smoking materials.
4. Do not overload tanks.
5. Keep filling nozzles in contact with the fill pipe to prevent sparks.
6. Secure the fill cap tightly; wipe away any spillage.
7. Ventilate all components for a minimum of five minutes before starting engines.
8. Keep fuel lines and bilges clean.

ENGINE IDENTIFICATION

When ordering service parts or obtaining information, always give the engine model and the serial number. This information can be found on the following decal.

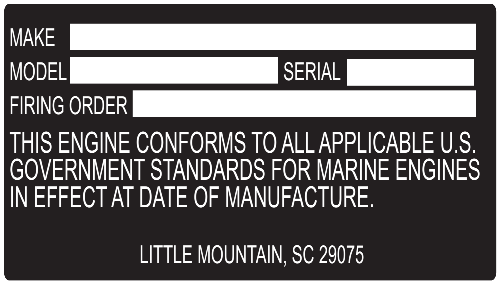


Figure 3-1 Engine Identification Decal

OWNER IDENTIFICATION AND REGISTRATION INFORMATION

We suggest that you record the following information for quick reference when ordering parts or requesting service or warranty.

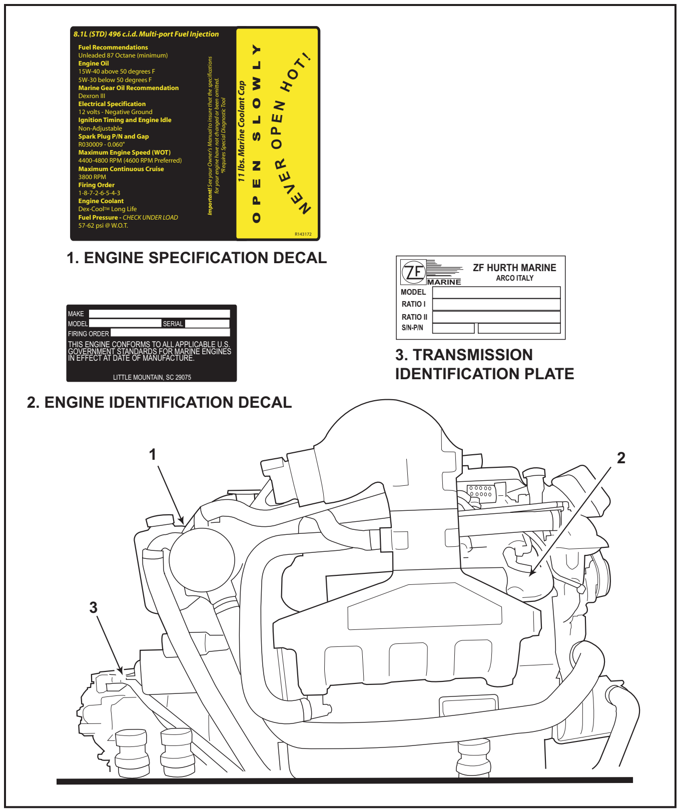


Figure 3-2 Engine Identification Tag Locations (8.1L)

	PORT	STARBOARD
Engine Model Number:		
Serial Number(s):		
Gear Model Number:		
Serial Number(s):		
Boat Make:		
Boat Model:		
Hull Serial Number:		
Propeller Size:		
Ignition Key Number:		

CRUSADER
ENGINE MODEL IDENTIFICATION / ADVISORY

MODEL **0 2 - 6 0 1 V - 0 1** SERIAL **690000**

1st - 2nd Space: **MANUFACTURING CODE**

3rd - 5th Space: **ENGINE CODE**

810 = 8.1L	(496 CID MPI)	(GM)
811 = 8.1L	(496 CID H.O. MPI)	(GM)
601 = 6.0L	(364 CID MPI) (LY6 Base)	(GM)
570 = 5.7L	(350 CID LH MPI)	(GM)
571 = 5.7L	(350 CID RH MPI)	(GM)
500 = 5.0L	(305 CID LH MPI)	(GM)
501 = 5.0L	(305 CID RH MPI)	(GM)

6th - 8th Space: **DRIVE CONFIGURATION**
- blank - Direct Drive
- **V** - V-Drive

9th - 10th Space: **SPECIFICATION CODE**

SERIAL NUMBER I.D.
1st DIGIT INDICATES DECADE ENGINE WAS MANUFACTURED (5 = 1990, 6 = 2000, 7 = 2010)
2nd DIGIT INDICATES CALENDAR YEAR ENGINE WAS MANUFACTURED.

ELECTRONIC FUEL INJECTION SYSTEM

The Crusader Marine Engines covered in this manual are equipped with an Electronic Fuel Injection (EFI) system, which allows precise control of fuel and spark delivery. The fuel system components of the EFI system are:

- The electric fuel pumps
- The throttle body assembly
- The fuel injectors

The fuel injection system is controlled by an Electronic Control Module (ECM). The ECM is the decision center of the system. The ECM constantly monitors information from various sensors on the engine, and electronically processes the information, in order to control ignition timing and fuel delivery for optimum performance and fuel economy. The ECM incorporates an engine overspeed protection, calibrated to a specific RPM, to prevent engine damage from over-revving.

The sensors that the ECM monitors are:

- Engine Coolant Temperature (ECT) Sensor
- Throttle Position (TP) Sensor
- Manifold Absolute Pressure (MAP) Sensor
- Knock Sensor (KS) System
- Crankshaft Positioning (CKP) Sensor
- Camshaft Positioning (CMP) Sensor
- Intake Air Temperature (IAT) Sensor
- Throttle Control Position (TCP) Sensor

If, for any reason, one or more of these sensors or associated wiring malfunctions, the ECM’s built-in self-diagnostic system sets a trouble code and turns on the “MIL” Malfunction Indicator Lamp or “Check Engine” lamp (if equipped) to alert the operator of a malfunction.

In most cases, when the “Check Engine” light is on, the engine(s) may lose some performance and/or efficiency, but remain running adequately. Also, the light may go out or become intermittent, but a trouble code will be logged for future diagnosis.

In any case, the operator must obtain service by an authorized Crusader Premier dealer to determine the exact cause of the malfunction.

INSTRUMENTATION

Boat manufacturers install many different types of instrumentation on boats. Become familiar with the instrumentation on your boat and be aware of abnormal operating conditions. Refer to Figure 5-1, the following is a brief explanation of typical instrumentation found on most boats:

1. Tachometer - indicates the engine RPM (revolutions per minute)
2. Engine Synchronizer/Cruise Control Panel (twin engines only)
3. Water Temperature Gauge - indicates the engine coolant temperature
4. Oil Pressure Gauge - indicates the engine oil pressure
5. Voltmeter - indicates the battery voltage and charging system voltage
6. Hour Meter - indicates the engine operating time
7. Fuel Level Gauge - indicates the fuel tank level
8. Malfunction Indicator Lamp (MIL) or Check Engine Lamp - indicates a problem with the engine control system

ENGINE ALARM SYSTEM (OPTIONAL)

The Crusader engine electronic system is programmed to control the engine alarm system. This system utilizes an indicator lamp (“MIL” or “Check Engine”) and/or an optional audible alarm to warn the operator of possible engine problems.

The alarm circuit has a “self” checking feature programmed into the system. This feature will momentarily light the “MIL”, and if equipped, sound the alarm for two short pulses upon initial start-up of the engine.

If the “MIL” lights and/or the alarm sounds during operation, observe the instrument panel readings for the possible source of the malfunction, such as low oil pressure or excessive engine temperature readings.

Other conditions that may sound the warning buzzer are a transmission over-temperature warning, exhaust gas over-temperature warning, and for an electronic throttle malfunction.

IMPORTANT: A failure involving the Electronic Throttle may result in ***Idle only*** operation of the engine. The operator must obtain service by an authorized Crusader dealer to determine the exact cause of this malfunction as soon as possible.

In most cases, when the “MIL” light is on, the engine(s) may lose some performance and/or efficiency, but remain running adequately. Also, the light may go out or become intermittent, but a trouble code will be logged for future diagnosis.

In any case, the operator must obtain service by an authorized Crusader Premier dealer to determine the exact cause of the malfunction.

NOTICE: Some boat builders may install their own alarm system. It is recommended that the boat owner check with his or her boat dealer for an explanation of the particular alarm system upon initial delivery.

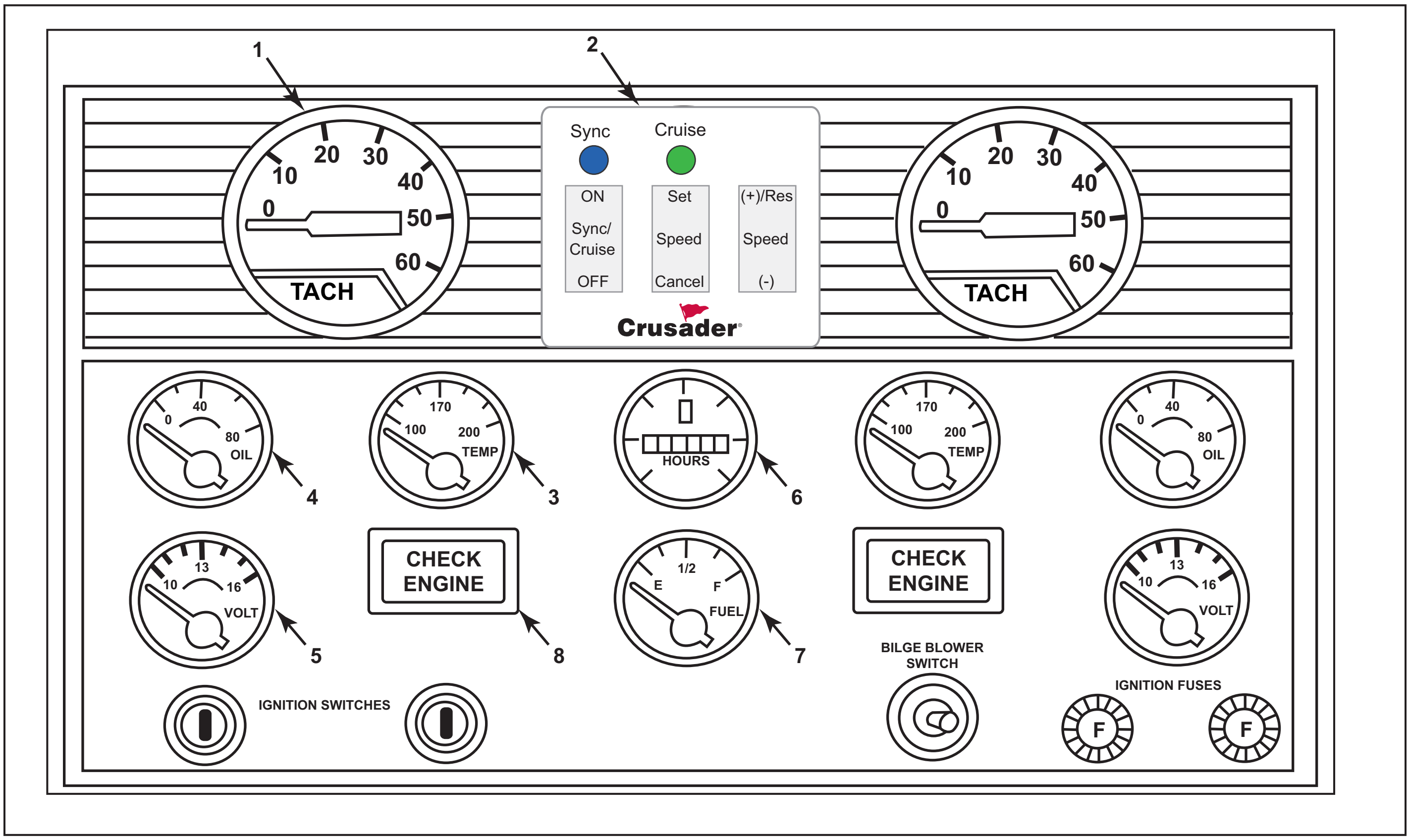


Figure 5-1 Typical Instrument Panel

REMOTE CONTROLS

Your boat may be equipped with one of many different types of remote controls available. Ask you dealer for a description and/or demonstration of the particular type installed on your boat.

⚠ CAUTION
Never shift transmission into or out of gear unless throttle is at the idle position. Shifting transmission above 1000 RPM can severely damage boat, transmission and engine.

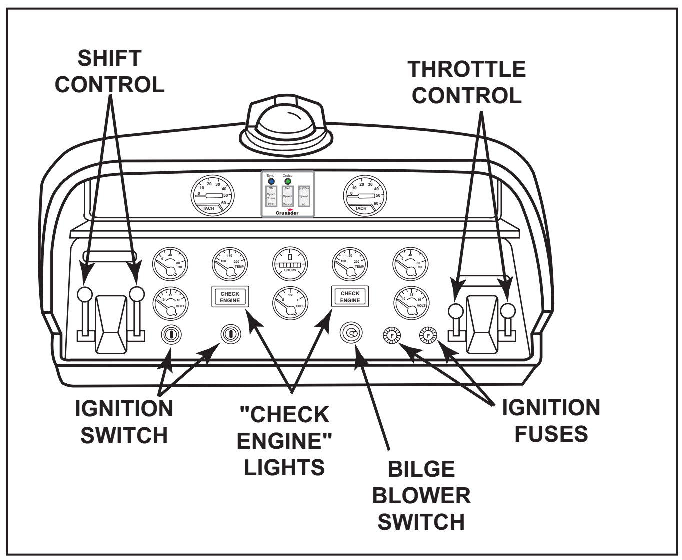


Figure 5-2 Typical Dash Layout

STARTING ENGINE (FUEL INJECTED ENGINES)

⚠ WARNING

Electrical, ignition and fuel system components on Crusader Marine Engines are designed and manufactured to comply with U.S. Coast Guard rules and regulations to minimize risks of fire.

IMPORTANT: Do not start the engine without water being supplied to the sea water pick-up pump or sea-water pump impeller will be damaged, and subsequent overheating damage to the engine may result.

IMPORTANT: The following items should be checked before starting the engine, and each time the boat is operated:

- Fuel system for any signs of leakage
- Operation of remote controls and steering
- Engine and transmission oil levels
- Fuel tank levels
- Exhaust system for leaks and tightness of the clamps
- Battery connections and water level in battery cells
- Accessory drive belt
- Cooling system for leaks. If equipped with fresh-water cooling, check coolant level in recovery bottle. Check for signs of water leaks at the exhaust manifolds, risers and elbows (Figure 5-2A). If the water is leaking externally, it is possible that the water is also leaking internally. This could result in internal engine damage. It is very important to service these maintenance items as soon as a problem is indicated.After performing the initial safety checks, proceed as follows to start the engine:

1. Turn the battery switch ON (if equipped).
2. Open the fuel valve.
3. Open the seacock.

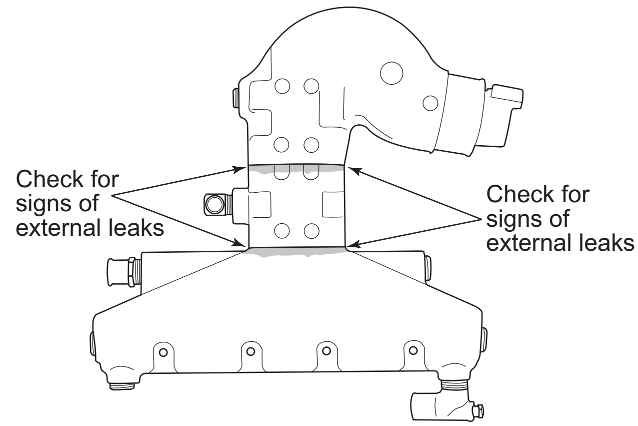


Figure 5-2A Water Leaks

4. Place the remote control in Neutral position. The transmission is equipped with a neutral safety switch, which will not allow the starter motor to operate unless the transmission is in neutral.
5. Do not pump or open the throttle when starting the engine (Figure 5-3). The ECM will automatically regulate the fuel and control desired idle speed.
6. Turn the ignition key to the start position. When the engine starts, release the key.

NOTICE: Engine idle speed is controlled by the ECM and is based on the operating temperature of the engine. Upon initial start-up, engine RPM will be slightly higher and will automatically decrease as the engine operating temperature increases.

7. In the event the engine becomes flooded, move the throttle lever to a 100% open position (Figure 5-3). At this throttle position, the ECM will command the injectors to deliver no fuel during engine cranking.

IMPORTANT: If the engine fails to start within 20-30 seconds, turn the ignition key to the OFF position and allow 2 minutes for the starter motor to cool off before attempting to restart the engine.

NOTICE: If equipped with the Sync/Cruise Speed Control System, ensure that the Sync/Cruise switch is OFF, otherwise the Slave engine will not recognize the "clear flood" mode.

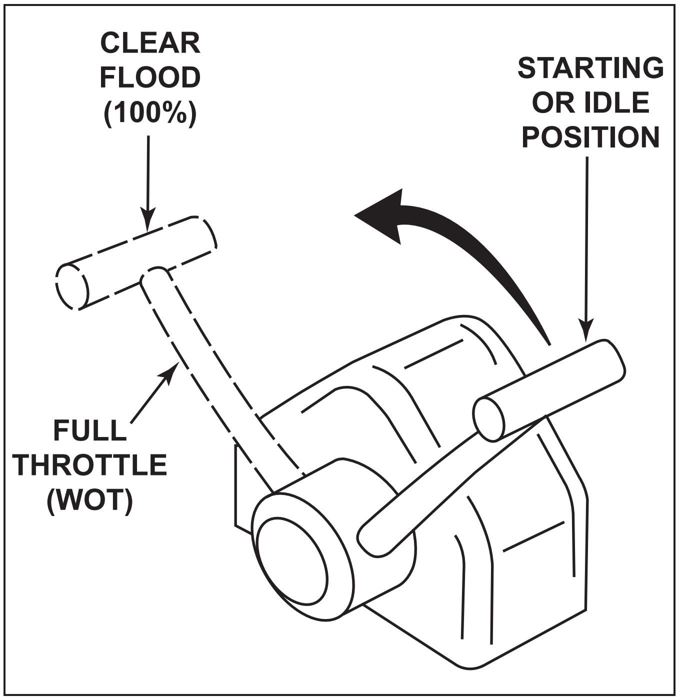


Figure 5-3 Throttle Position Setting

NOTICE: If the Slave engine fails to start, ensure that the Sync/Cruise switch is OFF, if equipped, and the Throttle lever is at the start/idle position.

NOTICE: If engine still fails to start, contact your Crusader Marine Engines Dealer for service.

8. Check engine oil pressure immediately after the engine starts. If oil pressure is not within specifications (see Engine Specifications), immediately stop the engine and determine the cause.

9. Check voltmeter for proper charging system operation.

10. Check the engine and transmission for fuel, oil, water and exhaust leaks.

11. Allow the engine to reach normal operating temperature. Check the temperature gauge to ensure the engine is operating within the normal temperature range. If the temperature is abnormally high, stop the engine immediately and determine the cause.

SHIFTING TRANSMISSION

CAUTION

Never shift the transmission into or out of gear unless the throttle is at the idle position. Shifting the transmission above 1000 RPM can severely damage the boat, transmission and engine.

1. Set the throttle lever at the idle position.

2. Move the transmission lever ***completely forward*** to shift into Forward gear.

3. Move the transmission lever ***completely backward*** to shift into Reverse gear.

4. Move the transmission lever to the ***center detent*** position to shift into Neutral.

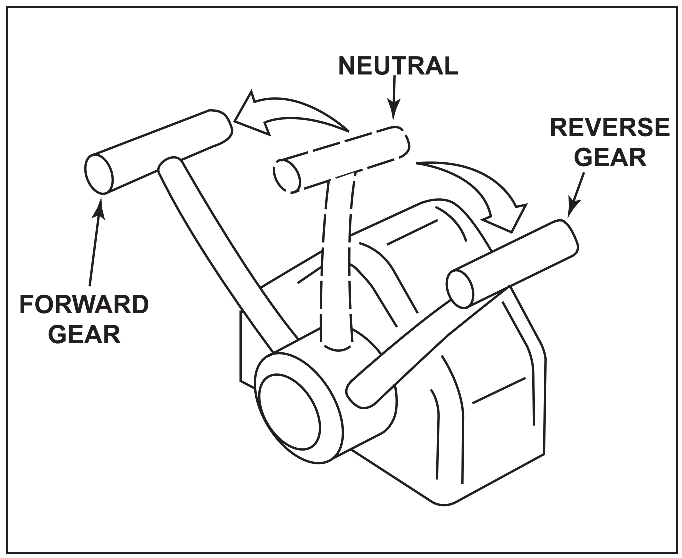


Figure 5-4 Shift Control

STOPPING ENGINE

When returning to the dock, or whenever stopping the engine, bring the throttle back to the idle position and ensure the transmissions are in Neutral. After the engine reaches idle speed, turn the ignition key to the OFF position.

Before stopping the engine after extended high speed operation, allow the engine to idle at 1200 RPM for 3 to 5 minutes to allow the engine to cool down before shutting off the ignition.

After stopping the engine, complete the following:

1. Turn the battery switch OFF, if equipped.
2. Close the fuel valve.
3. Close the seacock.
4. Flush the cooling system if in a salt water area.

FREEZING TEMPERATURE OPERATION

If the possibility of freezing exists, the cooling system must be protected after the engine is shut off to prevent freeze damage to the engine. Refer to OUT-OF-SEASON STORAGE for draining instructions.

OPERATION IN HIGH DEBRIS AREAS

If the boat is to be operated in high debris areas, a sea strainer should be installed in the water inlet hose to prevent debris from entering the cooling system. The strainer used must be of sufficient size to allow an adequate supply of water for cooling the engine. A minimum of 30 gallons per minute (114 liters per minute) flow rate is required.

ELECTRONIC TWIN-ENGINE SYNCHRONIZATION and CRUISE (OPTIONAL)

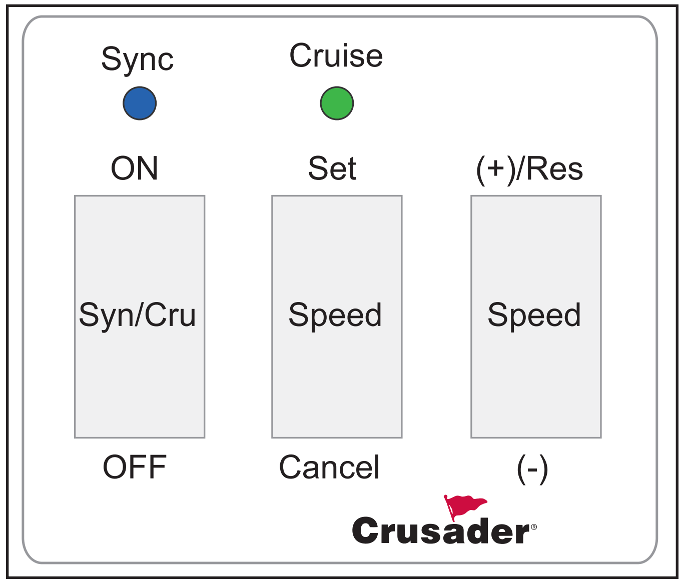


Figure 5-5 Sync/Cruise Control Panel (Typical)

Synchronization allows single throttle handle operation of both engines. When you are in Sync Mode, both engines maintain the same RPM. The 'Master" engine is controlled by the Master throttle handle and the "Slave" engine is electronically controlled to the same RPM as the Master engine.

Cruise Mode allows electronic control of the engines at an operator selected engine speed. When you are in Cruise Mode, both engines are electronically controlled to maintain the desired RPM regardless of sea conditions or maneuvers.

IMPORTANT: ***The electronic Synchronization/Cruise system requires one engine to be designated as a 'Master', and the other engine designated as a 'Slave'. The Master/Slave relationship is determined by the installer during engine installation; therefore if the installer does not identify which engine is the Master, the Master must be determined using the following procedure.***

DETERMINING THE MASTER/SLAVE ENGINE POSITIONS

For first time operation of the Sync/Cruise Mode, you may need to determine which engine is the 'Master' engine and which is the 'Slave' engine. Perform the following procedure in neutral gear, while secure in your boat slip.

1. Ensure the **Syn/Cru** Mode switch is in the OFF position.
2. Perform the engine starting procedure for both engines. Refer to the Starting the Engine procedure in this section of the manual.

With both engines running, in neutral, and with both throttle handles pulled back to the Idle/Start position:

3. Press the **Syn/Cru** Mode switch to the ON position. The Sync Lamp should be blinking, or steady ON, at this point.
4. With the Sync Lamp blinking or steady ON, start with the Port engine, and ***SLOWLY*** push each throttle forward, one at a time, and note which throttle increases engine RPM's.
5.. Place the throttle that ***DOES NOT INCREASE RPM'S*** in the wide-open-throttle position.
6. Move the throttle handle that ***does increase*** RPM's forward *slowly* and observe that both engines increase in RPM's. This engine is the Master engine.

Return the throttle handles to their Idle/Start positions, then place the Syn/Cru Mode Switch to the OFF position.

CRUSADER SYNCHRONIZATION / CRUISE PANEL FUNCTIONS

Refer to Figure 5-6.

(A) Syn/Cru Mode Switch - Switch A is a two position switch, which turns the engine synchronization and cruise functions ON or OFF. The cruise functions will not operate until the Syn/Cru Mode Switch (A) is pushed to the ON position even for single engine applications.

NOTE: Sync and Cruise functions that have been enabled, when Switch A is pushed to the OFF position, will remain in control of the engines until **both** throttle handles are pulled back below the previous set point.

(B) Speed Set/Cancel Switch - Switch B is a Momentary ON - OFF - Momentary ON, three position switch, which controls the Cruise function. When you have reached the desired cruise speed, press Switch B to the **Set** position and move the Master throttle handle to the wide open throttle position. The engine ECM stores the Set value in memory and controls both engines to the Set RPM. Pressing Switch B to the **Cancel** position and moving the Master throttle handle below the Set point will disengage Cruise mode, engine Synchronization is not affected.

NOTE: If a cruise speed has been set and Switch A is pushed to the OFF position, or Cruise Mode is Cancelled by Switch B, the Set speed will remain in the ECM memory. The stored Set speed may be resumed when the engines are brought back into Sync/Cruise Mode, even if the engines' ignitions have been turned off.

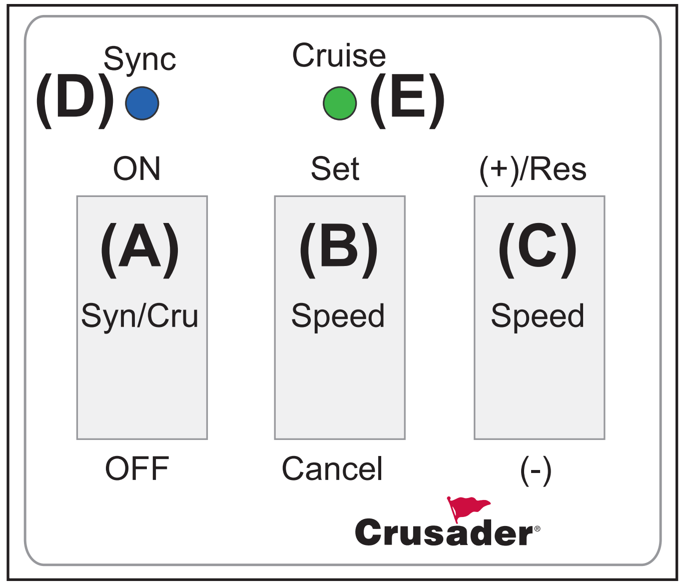


Figure 5-6 Sync/Cruise Control Panel (Typical)

(C) Speed (+)/Res / (-) Switch - Switch C is the same type of switch as switch (B), it is used to modify or resume the Cruise mode Set speed. If Cruise Mode has been Cancelled and the previous Set speed is still desired, momentarily pressing Switch C to the **(+)/Res** position then move the Master throttle handle past the previous set point this will Resume Cruise Mode at the previous Set speed. While in Cruise Mode, momentarily pressing Switch C to the **(+)/Res** position will increase the engine Set speed 20 RPM each time it is pressed. Pressing Switch C to the **(-)** position will decrease the engine Set speed 20 RPM each time it is depressed. Pressing and holding Switch C, a minimum of 3 seconds, will slowly ramp engine speed up or down.

(D) Sync Lamp - Indicates the status of the Sync/Cruise system. **OFF** - indicates the Sync/Cruise system is off; Switch A is in the OFF position. **ON** - indicates the Sync/Cruise system is enabled and in Synchronization Mode; Switch A is in the ON position and the Master throttle has control over both engines. **Flashing** - indicates that the Sync/Cruise system is enabled but is unable to achieve synchronization because the Slave throttle is below the Master throttle position.

(E) Cruise Lamp - Indicate the status of Cruise Mode. **OFF** - indicates that a cruise speed has not been set or Cruise Mode has been Cancelled. **ON** - indicates that Cruise Mode has been engaged and the desired cruise speed has been achieved. **Flashing** - indicates that Cruise Mode is engaged but the cruise Set speed has not been met. The previous set speed may be Resumed and/or the Master throttle position is below the previous Set speed.

NORMAL OPERATION

Prior to and/or after turning OFF the Crusader Sync/Cruise system, the operator has total, independent control of the engines. The engines may be operated independent of each other as required by the location and circumstances of the operators' surroundings.

The use of Normal Operation is recommended when leaving the dock, operation in close maneuvering situations and when performing docking maneuvers.

ENTERING SYNC MODE

Refer to Figure 5-6.

Enter Sync Mode at idle, in Neutral gear. Once you have entered Sync Mode, you must have the Master handle in the Idle/Start position whenever you are shifting the transmissions into or out of gear. Remember that Sync Mode enables both engines to be operated by a single throttle handle, the Master.

1. Position both throttles to their Idle/Start position. Perform the engine starting procedure for both engines. Refer to the Starting the Engine procedure in this section of the manual.
2. Press the **Syn/Cru** Mode switch (A) to the **ON** position.
3. Press the **Speed Set/Cancel** switch (B) to the **Cancel** position.
4. With the **Sync** Lamp flashing or steady ON, slowly push the Slave engine throttle handle to the full forward position.
5. The operator now has control of both engine speeds by using the Master throttle handle, only.

NOTE: If the Slave throttle position is below the Master throttle position the Sync Lamp will be flashing. When the Slave handle is moved equal to or above the Master, the Sync Lamp will remain steady ON. The Master engine only has throttle authority up to the position of the Slave handle. For example, Sync is engaged at 1000 RPM, the Slave handle is then placed at the half throttle position. As the Master throttle position is increased, both engines will run at the same RPM up to the Slave handle position. If the Master handle is pushed beyond the Slave position, the Master engine will continue to increase in engine speed, but the Slave engine will remain at the engine speed allowed at the half throttle position. The Sync Lamp will begin flashing indicating that Sync Mode is requested, but the Slave engine cannot be synced with the Master. Sync Mode can be resumed by placing the Slave handle in a position equal to or beyond the Master handle. The Sync Lamp will be ON when you are synced.

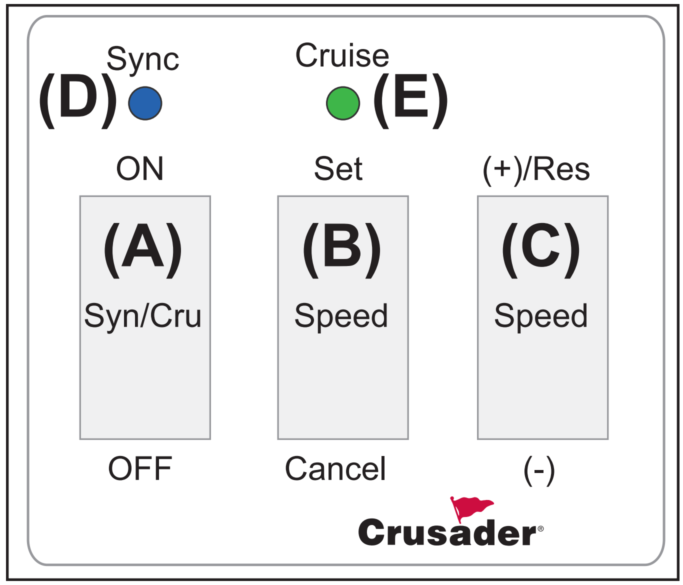


Figure 5-6 Sync/Cruise Control Panel (Typical)

ENTERING CRUISE MODE

NOTE: You must be in Sync Mode prior to entering Cruise Mode.

1. Move the Master throttle to the desired engine speed.
2. Press the **Speed Set/Cancel** switch (B) to the **Set** position. Slowly, push the Master handle to the full forward position.
3. The **Cruise** Lamp (E) should be steady ON indicating that Cruise Mode is engaged.

NOTE: The operator may reduce the speed of the engines, at any time, by reducing the Master throttle handle position below the cruise speed set point. The **Cruise** Lamp (E) will begin flashing. Returning the Master throttle handle to any point above the cruise speed set point will resume the previous set speed. The **Cruise** Lamp will be ON.

NOTE: The Master and Slave throttle handles should both be in the full forward positions. This allows the electronic engine control sufficient range to adjust and maintain the engines at the desired set speed.

ADJUSTING THE CRUISE SET SPEED

1. Press the **Speed (+)/Res / (-)** switch (C) to the **(+)/Res** position will increase engine speed 20 RPM per switch cycle.
2. Press the **Speed (+)/Res / (-)** switch (C) to the **(-)** position will decrease engine speed 20 RPM per switch cycle.
3. Press and hold the **Speed (+)/Res / (-)** switch (C) for 3 seconds or longer will cause the speed to slowly ramp up (**(+)/Res**) or down **(-)**. Release the switch when the desired engine speed is achieved, this will be the new set speed.

CANCELLING THE CRUISE SET-POINT

1. Press the Speed Cancel switch.
2. Pull the Master throttle handle back below the set point.
3. The Cruise Lamp will go OFF indicating that the operator has full synchronized throttle control over the engines.

IMPORTANT: ***ONLY*** *the Cruise speed set-point has been cancelled. The engines remain in Sync Mode with the Master throttle handle in control of both engine speeds. At this point, a new set speed can be selected or you may use the Resume Mode to go back to the previous set speed.*

RESUME MODE

1. After cancelling Cruise, the previous set speed may be resumed by pressing the **Speed (+)/Res / (-)** switch (C), to the **(+)/Res** position.
1. Push the Master throttle handle forward above the previous Cruise set-point.

EXITING SYNC/CRUISE MODES

1. Press the **Syn/Cru** Mode switch (A) to OFF.
2. The **Sync** (D) and **Cruise** (E) Lamps will go OFF.
3. Return both throttle handles back to the Idle/Start position.
4. The operator has full individual throttle control over the engines.

IMPORTANT: Sync/Cruise mode will remain engaged until ***both the Master and Slave throttles*** are returned below the sync/cruise set point.

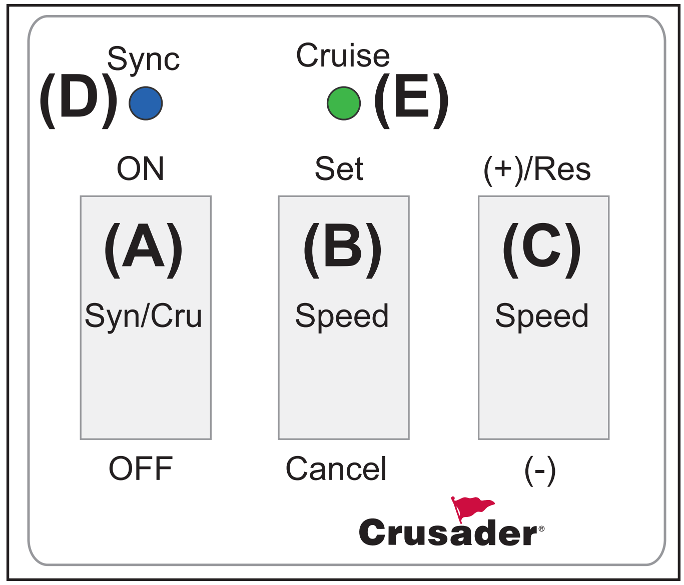


Figure 5-6 Sync/Cruise Control Panel (Typical)

SYNC/CRUISE FUNCTION VS. THROTTLE POSITION

FUNCTION	MASTER THROTTLE	SLAVE THROTTLE
Starting Engines - **Syn/Cru** Mode Switch (A) OFF	Idle/Start	Idle/Start
Engines Synchronized - **Syn/Cru** Mode Switch (A) ON	Under Operator's Control	WOT
Engines w/Cruise Speed **Set** (Switch (B))	WOT	WOT
Adjust Cruise Set Speed (Switch (C))	WOT	WOT
Cancel Cruise Set Speed (Switch (B)); Engines Remain Synchronized	Under Operator's Control After Throttle is reduced Below Cruise Set Speed	WOT
Return to Operator's Total Control After Turning **Syn/Cru** Mode Switch (A) OFF	Idle/Start Required to Ensure Cancellation of All Sync/Cruise Functions	Idle/Start Required to Ensure Cancellation of All Sync/Cruise Functions

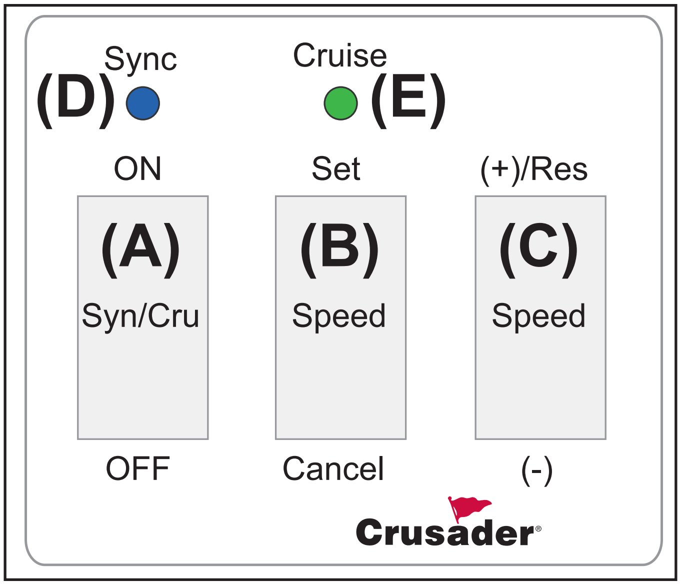


Figure 5-6 Sync/Cruise Control Panel (Typical)

CRUSADER SYNC/CRUISE - POSSIBLE OPERATOR CONCERNS

Concern	Possible Cause	Corrective Action
Sync Lamp Flashing While Boat is Under Way	Slave throttle handle position is below the Master throttle handle position.	Place Slave throttle handle to the WOT position.
Cruise Lamp Flashing when Syn/Cru Mode switch is turned ON.	A previous cruise set speed remains in system memory.	Press **Cancel** on the **Speed Set/Cancel** switch (B). OR - Use the **Res**ume function (Switch C), then place the Master throttle in the WOT position to Resume previous Cruise mode function and Set speed.
Cruise Lamp Flashing while under way, Cruise Mode is enabled.	Engines are operating below the cruise Set speed.	Place the Master throttle to the WOT position.
The Slave engine is running slower than the Master engine and the Sync Lamp is flashing.	The Slave throttle position is below the Master throttle position.	Place the Slave throttle to the WOT position.
After re-starting the engines, the Slave engine does not speed up and follow the Master as the Master throttle is increased.	The Slave throttle position was not returned to the Idle/Start position before re-starting the engines.	Return the Slave throttle to the Idle/Start position then place the Slave throttle in the WOT position.
The Slave engine will not re-start with the Syn/Cru switch OFF.	The Slave throttle was not returned to the Idle/Start position before attempting to re-start the engine.	Place the Slave throttle in the Idle/Start position and start the engine.

TRIM AND WEIGHT DISTRIBUTION

Trimming of the boat and positioning of the weight (gear and passengers) inside the boat has the following effects on handling:

- Trimming the bow up or shifting weight to the stern (rear).
  - Normally used for cruising (running) with a choppy wave condition (following sea) for running at full speed
  - Will generally increase speed and engine RPM
  - Will cause the bow to bounce in rough water
  - In extreme, may cause the boat to porpoise
  - When coming off plane, it increases the chances of following wave splashing into the stern of the boat
- Trimming the bow down or shifting the weight to the bow (front)
  - Normally used for cruising (running) against a choppy wave condition, acceleration onto plane and operating at slow planing speeds
  - Will improve rough water ride and handling
  - In extreme, may cause the boat to bow steer (veer back and forth with little control)

BOAT BOTTOM

To ensure maximum engine performance, fuel economy and boat speed, the bottom of your boat must be kept clean and free of marine growth and barnacles. Marine vegetation may accumulate when the boat is docked and should be removed before operation. If the boat is docked for long periods of time, the water inlets may become clogged with growth and will cause the engine to overheat.

In most areas, it is advisable to coat the boat bottom with antifouling paint to prevent the build-up of marine growth. Contact your dealer for advice on these requirements in your area.

PROPELLER SELECTION

Best all-around performance and maximum engine life is achieved when the engine is propped to run near the top of (but within) the recommended full throttle RPM range with a normal load. See ENGINE SPECIFICATIONS for rated full throttle RPM for your model engine.

Generally, gross weight (total weight of the entire boat, including full fuel and water, optional equipment, passengers and other miscellaneous gear) is one of the major factors and should be one of the primary considerations when selecting a propeller. Other factors to take into consideration are as follows:

- Warmer weather and higher humidity will cause an RPM loss.
- Operating the boat in a higher elevation will cause an RPM loss.
- Operating the boat with an increased load will cause an RPM loss (additional equipment, passengers, etc.).

If full throttle RPM is above or below the recommended range as stated in ENGINE SPECIFICATIONS, the propeller must be changed to prevent loss of performance. A one-inch change in the pitch of a given propeller will generally change engine RPM by 150 to 250 RPM.

ENGINE RPM CHART

Model	Minimum Full Load	Preferred	Maximum
MP 5.0L	4600	4800	5000
MP 5.7L	4800	5000	5200
MP 6.0L	5200	5500	5600
MP 8.1L (STD)	4400	4600	4800
MP 8.1L (H.O.)	4800	5000	5200

CAUTION

Prolonged WOT operation will shorten the life of your engine and could cause premature engine failure. See NORMAL CRUISING SPEEDS in SPECIFICATIONS. Problems caused by WOT operation are considered abuse and are not covered under the Crusader Warranty.

IMPORTANT NOTICE: ***Your new Crusader engine incorporates an RPM "MAX GOVERNOR" in order to prevent the engine from over-revving. Operation above the Maximum RPM listed in the chart above is not recommended. If your engine is operating above the maximum a higher pitched propeller is required to lower the engine maximum RPM to the Preferred RPM listed in the chart above.***

WARNING

Use this procedure ONLY when conditions are such that it can be done in complete safety.

The break-in period of your engine is the first 25 hours of operation. Proper engine break-in is essential to achieve maximum performance, longevity and minimum oil consumption. During the break-in period, the following operation guidelines must be adhered to:

- After the engine is thoroughly warmed up, and the boat is underway, open the throttle to wide open throttle until maximum RPM is reached. DO NOT EXCEED MAXIMUM RPM. (RPM should cease climbing after 10 to 20 seconds).

CAUTION

DO NOT operate at full throttle in neutral at any time, or at sustained full throttle during the first 5 hours of operation. Thereafter, use sustained wide open throttle in the event of an emergency.

- Reduce the throttle to 2800 - 3000 RPM, and cruise at or below this speed for 1/2 hour. Reduce the speed to idle. Go to wide open throttle until maximum RPM is reached and operate for approximately 1 minute. Reduce throttle to 2800-3000 RPM and operate for a few minutes. (Bringing the engine speed from idle to wide open throttle will load the engine and assist in seating the piston rings.) This cycle should be repeated from time to time during the first 5 hours of operation, but wide open throttle should not be sustained for more than 1 minute.

- During the remaining 20 hours of the break in period, the engines can be run at cruise speeds that are approximately 75-80% of the wide open throttle RPM, occasionally varying the cruise speed by 100 RPM.

- During the early part of the break in period, the correct propeller selection can be confirmed. (With a normal load aboard, the engine's RPM should reach, but not exceed, the maximum RPM as listed in the specifications section.)

- During the break in, all gauges should be watched carefully, and the speed should be reduced if abnormal readings become evident.

CAUTION

DO NOT attempt to break in any engine by prolong idling, or running at the dock.

The engine oil level should be checked often and oil added when necessary. It must be understood that every internal combustion engine will use a certain amount of oil during operation to act as a lubricating and cooling agent, especially during the break-in period. Oil consumption should decrease and become stabilized after approximately 100 hours of operation.

At the end of your 25-hour break-in period, contact your dealer and have the recommended 25-hour inspection done.

NOTICE: Crusader Marine Engines assumes no responsibility for the costs related to the 25-hour inspection. This is the owner's responsibility.

25-HOUR ENGINE INSPECTION - 8

After the first 25 hours of operation, it is recommended that the engine be given an inspection. Your boat dealer or a Crusader Premier servicing dealer should be contacted to perform the necessary checks and adjustments to ensure the proper engine performance. The following maintenance should be performed:

- Change the engine oil and filter.
- Check and clean the primary fuel filter.
- Check the engine alignment.
- Inspect the accessory drive belt(s) and check the tension.
- Check all the fluid levels.
- Check the throttle and the shift cable adjustments and check for freedom of movement.
- Cooling System - Inspect all the hoses for leaks, damage and deterioration. Check all the hose clamps for adequate tightness.
- Exhaust System - Inspect the entire exhaust system for leaks, damage and deterioration. Check all the hose clamps for adequate tightness.
- Battery - Check the electrolyte level and specific gravity. Inspect the case for damage. Check the battery cables and connections.
- Engine Assembly - Check for loose, missing or damaged parts. Pay close attention to engine mounts, starter and alternator mounting fasteners.

NOTICE: Crusader Marine Engines assumes no responsibility for the costs related to the 25-hour inspection. This is the owner's responsibility.

GASOLINE REQUIREMENTS

CAUTION

Fire and Explosion Hazard - Gasoline is extremely flammable and highly explosive, and , if ignited, can cause serious bodily injury or death. Careful inspection of the entire fuel system including, but not limited to, fuel tanks, fuel lines, fuel filters and all fittings is mandatory, especially after periods of storage. Replace any component that shows signs of leakage, corrosion, deterioration, swelling, hardening or softening.

WARRANTY NOTICE: Damage caused to the engine through the use of improper gasoline, low-quality or gasoline with an octane rating below the minimum requirements listed below, is considered misuse of the engine. Such damage is not covered by the Crusader Marine Engines warranty.

The ignition timing set by the factory requires the use of a high-quality lead-free regular gasoline with the following minimum octane specification.

Pump Octane Number (R+M/2) (PUMP) - 87

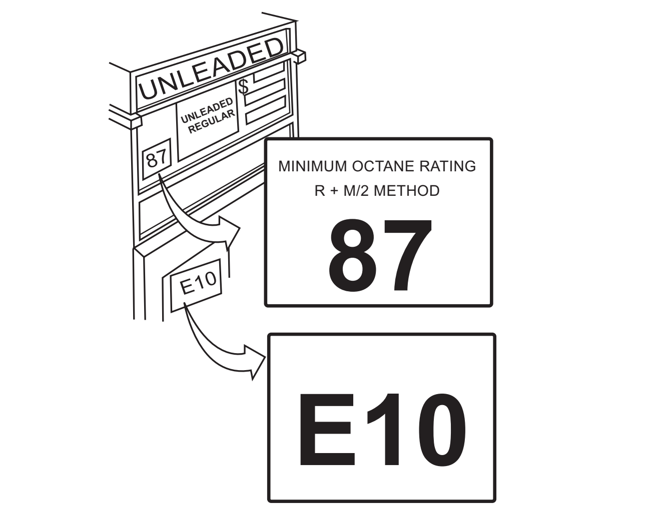


Figure 9-1 Fuel Requirements

NOTICE: Crusader Fuel Injected engines are calibrated to operate on and provide optimum performance when using fuel with at least an 87 octane fuel rating. Crusader's engine contorl module incorporates Adaptive Learn Technology to ensure optimum engine performance is obtained when using fuel rated higer than 87 octane.

If a slight pinging is heard during acceleration and the proper octane fuel is being used, it is considered normal. If a constant, heavy knock occurs, the engine should be evaluated by a Crusader Marine Engines service technician.

GASOLINE CONTAINING ALCOHOL

The implementation of ethanol-based fuel is spreading rapidly throughout the United States. As such, Crusader Engines provides the following information regarding the use of this fuel.

This information addresses the use of ethanol fuels in CRUSADER ENGINES ONLY. It does not address the use of ethanol fuels in vessel related components such as boat gas tanks, boat fuel lines, etc.

Ethanol blended fuel rated E10 or less is acceptable to use. Fuels rated higher than E10 SHOULD NOT BE USED. Ethanol fuels rated higher than E10 could potentially damage the engine and/or present an unsafe boating condition. Damage to the engine resulting from the use of ethanol fuel rated higher than E10 IS NOT covered by the warranty.

CAUTION

Do Not use any gasoline that contains METHANOL. This fuel is very corrosive and will create unsafe operating conditions. Serious damage will result from the continued use of fuel containing METHANOL. Any resulting engine damage will not be covered by the warranty.

If ethanol blended fuel rated E10 or less is used, or if the presence of alcohol is uncertain, more frequent inspections and service of the complete fuel system are required. Any sign of fuel leakage or deterioration must be repaired immediately before further engine operation.

It is important to note that ethanol blended fuel will act as a solvent and will attract and hold moisture. ***Without proper fuel stabilization and fuel filtration, ethanol blended fuel may cause the following:***

- Excessive moisture (water) may cause lean operation to include hard starting and operating difficulties such as, vapor lock, low speed stalling, and shortened fuel shelf life.
- Acting as a solvent, ethanol blended fuel may cause gum, sediment, sludge, and other particles to be loosened and carried through the fuel system to the engine.

Fuel system or engine damage caused by contamination from water, foreign particles, sludge, or gums entering or forming in the fuel system is not covered by the Crusader Limited Warranty.

Fuel Stabilizer Recommendations for Ethanol Blend Fuel

The use of a commercially available fuel stabilizer, such as STA-BIL®, is recommended when storing ethanol-blended fuel for more than ***2 weeks***.

ENGINE OIL RECOMMENDATIONS

Use of Supplemental Additives

Engine oils meeting Crusader Marine Engines' recommendations already contain a balanced additive treatment. The use of supplemental additives which are added to the engine oil by the customer are unnecessary and may be harmful. Crusader Marine Engines does not review, approve or recommend such products.

Synthetic Oils

Synthetic engine oils may be used in Crusader Marine Engines. Synthetic oils must meet the Engine Oil Requirements for Classification and Viscosity listed below. The use of synthetic oil **does not** permit the extension of oil change intervals.

Engine Oil Requirements

The following chart shows the recommended oil viscosity for various ambient temperature ranges:

Prevailing Ambient Temperature	Recommended A.P.I. Classification & Viscosity
Above 50˚F	SAE 15W-40 "GF-4/SM"
Below 50˚F	SAE 5W-30 "GF-4/SM"

IMPORTANT: The use of oils which contain "solid" additives, non-detergent oils or low quality oils specifically are not recommended.

WARRANTY NOTICE: Crusader Marine Engines reserves the right to refuse warranty on part(s) and/or engine(s) damaged by using improper fuels and engine oils.

Oil Change Intervals (Common)

Crankcase oil and oil filter change - Recommended intervals:

- Initial oil change - 1st 60 days or 25 hours of operation, whichever occurs first
- Regular oil changes - Every 50 hours of operation or 120 days, whichever occurs first

TRANSMISSION AND "V"-DRIVE OIL REQUIREMENTS

Transmission and "V" Drive	Recommended A.P.I. Classification and Viscosity
Velvet Drive Transmissions and "V" Drives - All	Dexron III Automatic Transmission Fluid (ATF) or equivalent
Walters "V"-Drive	Exxon Spartan EP-68 or SAE 30 Engine Oil
All Hurth Gear Transmissions	Dexron III Automatic Transmission Fluid (ATF) or equivalent

NOTICE: WALTERS "V"-DRIVES ONLY - A low oil pressure warning light is mounted on Walters "V"-Drives. The warning light will stay illuminated until the boat gets underway, and the engine speed increases to sufficient RPM for the pump to maintain pressure. This normally occurs at approximately 1200 RPM. Extended cruising at low RPM, such as when trolling, is not harmful to the "V"-drive, even though the warning light may remain illuminated.

ENGINE MAINTENANCE

Refer to the MAINTENANCE SCHEDULE for a complete listing of required maintenance and the frequency at which it should be performed. Some procedures may be performed by the owner/operator while others should be performed by an authorized Crusader Marine Engines Premier Dealer. Before performing any maintenance or repair procedure not covered in this manual, it is strongly recommended that a Crusader Marine Engines repair manual be purchased and read thoroughly.

CHECKING FLUID LEVELS

Engine Crankcase Oil

CAUTION

Do Not overfill engine crankcase with oil. Excessive oil can lead to premature engine component failure and/or loss of performance.

IMPORTANT: ***The engine oil level must be checked while the boat is in its normal, level, at rest position on the water. Excessive wave action side to side or fore and aft may cause you to obtain erroneous readings. If the oil level is being checked while the boat is on a trailer, ensure the trailer is on level ground, then adjust the trailer so the boat is at its normal, at rest position. Excess water in the bilge and, if equipped, ballast systems must be purged when checking the engine oil level, otherwise erroneous readings may be obtained.***

1. **Stop** the engine if running. Allow approximately 5 minutes for the oil to drain back into the oil pan.
2. Remove the dipstick, wipe it clean, and reinstall it until it is within two (2") inches of being fully seated. Slowly move the dipstick up and down approximately one-half (1/2") several times; then fully seat the dipstick into the dipstick tube.
3. In order to obtain an accurate reading, wait two minutes for the oil to stabilize on the dipstick. Remove the dipstick and observe the oil level. The oil level must be between the "FULL" and "ADD" marks. If the oil level is below the "ADD" mark, add specified oil to bring the level up to, but not over, the "FULL" mark on the dipstick. If the oil level is above the "FULL" mark on the dipstick, remove the excess oil. (Figure 11-1)

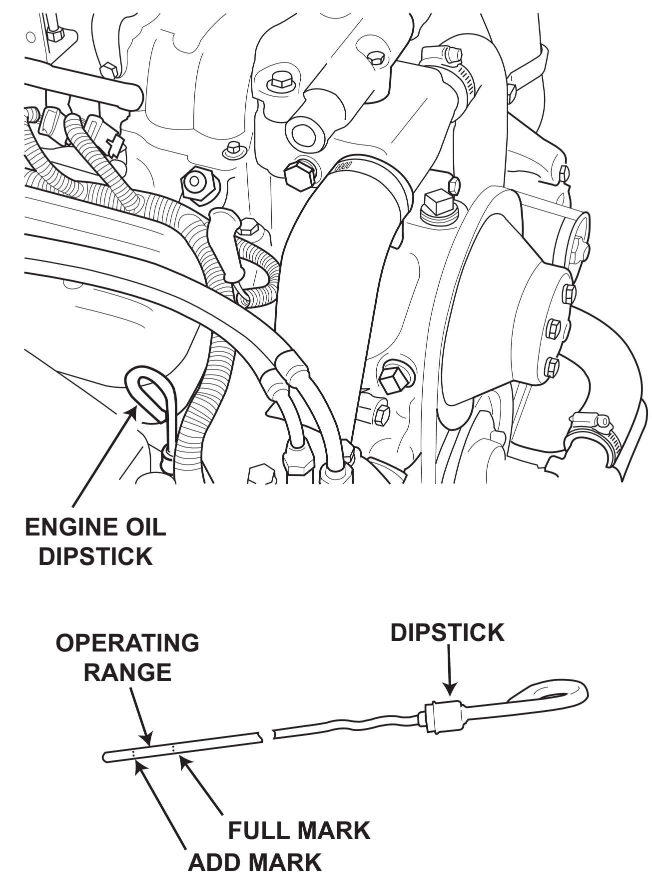


Figure 11-1 Engine Oil Dipstick (Typical)

WARNING

The machinery space <u>must be closed</u> anytime the engine is running to prevent injury to you or others on board. Never operate the engine while someone is in the machinery space, either closed or open. Never open the machinery space unless the engine is shut off and the engines rotating parts are stationary. Rotating machinery can cause injury and even death if an accident should occur. Extreme care must be exercised if a problem exists that requires operation of the engine with the machinery space open. ***IT IS RECOMMENDED THAT UNCOVERED ENGINE OPERATION BE ATTEMPTED BY TRAINED AND QUALIFIED SERVICE PERSONNEL ONLY.***

Transmission Fluid

CAUTION

Crusader Marine Engines uses marine transmissions supplied by several manufacturers. The maintenance requirements can be different between these manufacturers. It is important that you refer to the operation and maintenance manual supplied by the transmission manufacturer before you attempt to perform maintenance on your own. If no maintenance manual is available, Crusader Marine Engines recommends that you contact your dealer service department for any required maintenance or service instructions.

1. Remove the dipstick by turning the T-handle counterclockwise. Observe the fluid level. Replace the dipstick and tighten securely.

WARNING

Do not attempt to remove the transmission dipstick while the engine is running. Hot transmission fluid could be sprayed from the dipstick hole.

2. Operate the engine until the engine and the transmission reach operating temperature.

3. Stop the engine and quickly check the fluid level to minimize the drain-back from the oil cooler. Remove the dipstick by turning the T-handle counterclockwise. Observe the fluid level.

4. The fluid level should be at the “FULL” or “MAX” mark. If low, add the specified fluid through the dipstick tube. Repeat checking procedures as required until the fluid level is at the “FULL” or “MAX” mark.

5. Replace the dipstick and tighten securely.

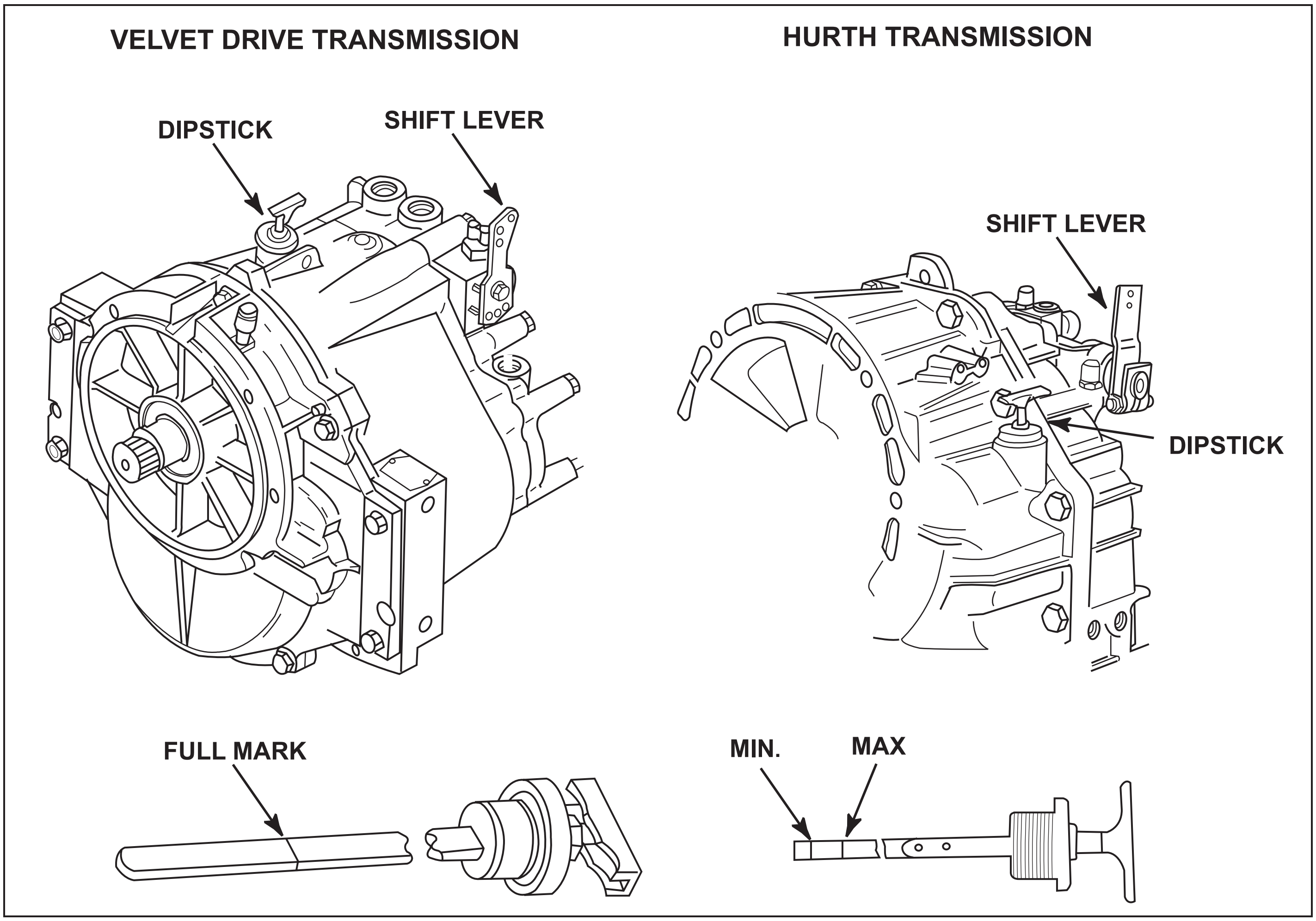


Figure 11-2 Transmission Dipstick and Location

LUBRICATION

Throttle Cable

Lubricate pivot points and exposed cable (Figure 11-3) with SAE 30W-30 engine oil.

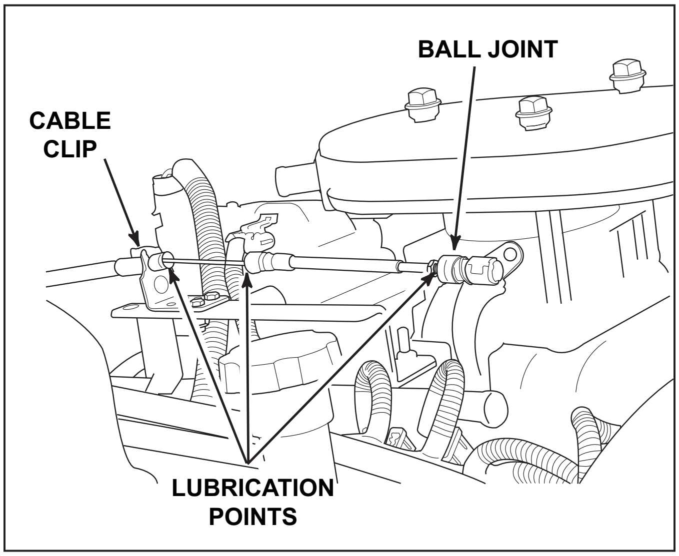


Figure 11-3 Typical Throttle Cable

Shift Lever

All Velvet Drive Transmissions - Lubricate the detent ball and holes in shift lever (Figure 11-4) with white grease (Lubriplate or equivalent).

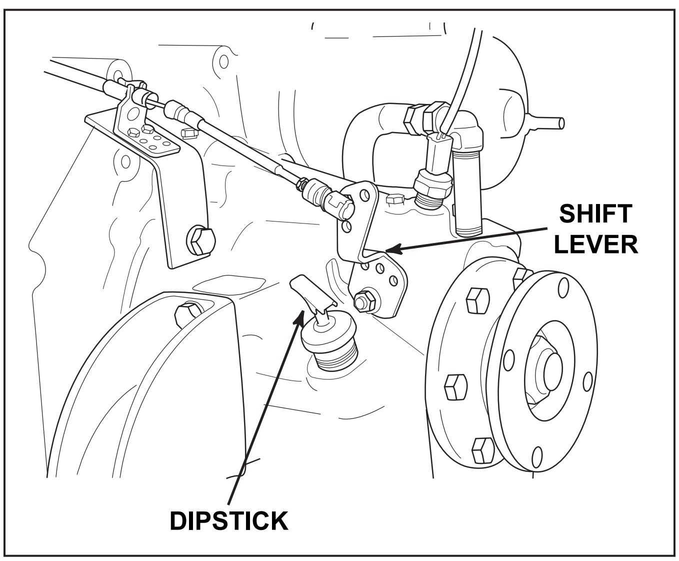


Figure 11-4 Transmission Shift Lever - Velvet Drive 5000

Shift Cable

Lubricate pivot points and exposed cable (Figure 11-5) with SAE 30W-30 engine oil.

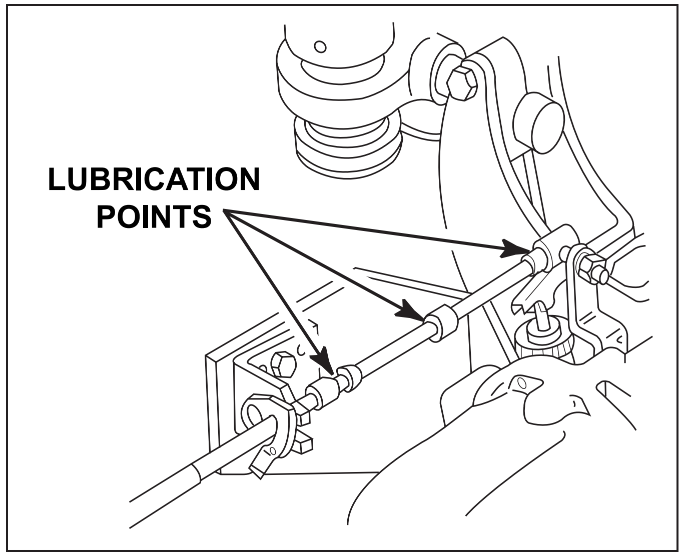


Figure 11-5 Typical Shift Cable

ELECTRICAL SYSTEM RELAY AND FUSE BLOCK

MAIN PANEL FUSE

Crusader engines are equipped with a 40 Amp PANEL fuse which provides electrical overload protection for the boat's instrumentation wiring and components. Should an electrical overload occur, the PANEL fuse will open and prevent electrical current flow.

When this fuse opens, the cause for the high current draw must be found and corrected. Check the battery and alternator connections and all other harness connectors between the boat and the engine main harness. Check for loose or disconnected lead wires and shorted circuits. Replace the PANEL fuse and resume operation. If the cause of the overload cannot be found, consult a Crusader Marine Engines Premier dealer to make necessary repairs.

ELECTRICAL SYSTEM FUSES

Crusader engines utilize fuses to protect critical engine components and devices. The fuel pump, ECM, ignition components, fuel injectors, starter and diagnostic devices are protected by fuses. The fuse block is mounted on a bracket near the rear of the engine close to the Heat Exchanger.

BOAT'S IGNITION FUSE

If the engine will not crank when the ignition key is turned to the START position, first check that the shift lever is in the neutral position and the safety lanyard (if equipped) is attached properly. If none of the Fuse Block fuses are open, check for a blown boat ignition fuse. The boat's ignition fuse may be located on the instrument panel, the fuse holder block or as part of the helm's instrument wiring harness. Check the wiring diagrams supplied from the boat manufacturer for the exact location.

ELECTRICAL SYSTEM WIRING AND CONNECTORS

The electrical system wiring and connectors should be checked periodically for loose or dirty connections and damaged wiring. If electrical components or wiring show signs of corrosion, deterioration or damage, consult a Crusader Marine Engines Premier dealer to make necessary repairs.

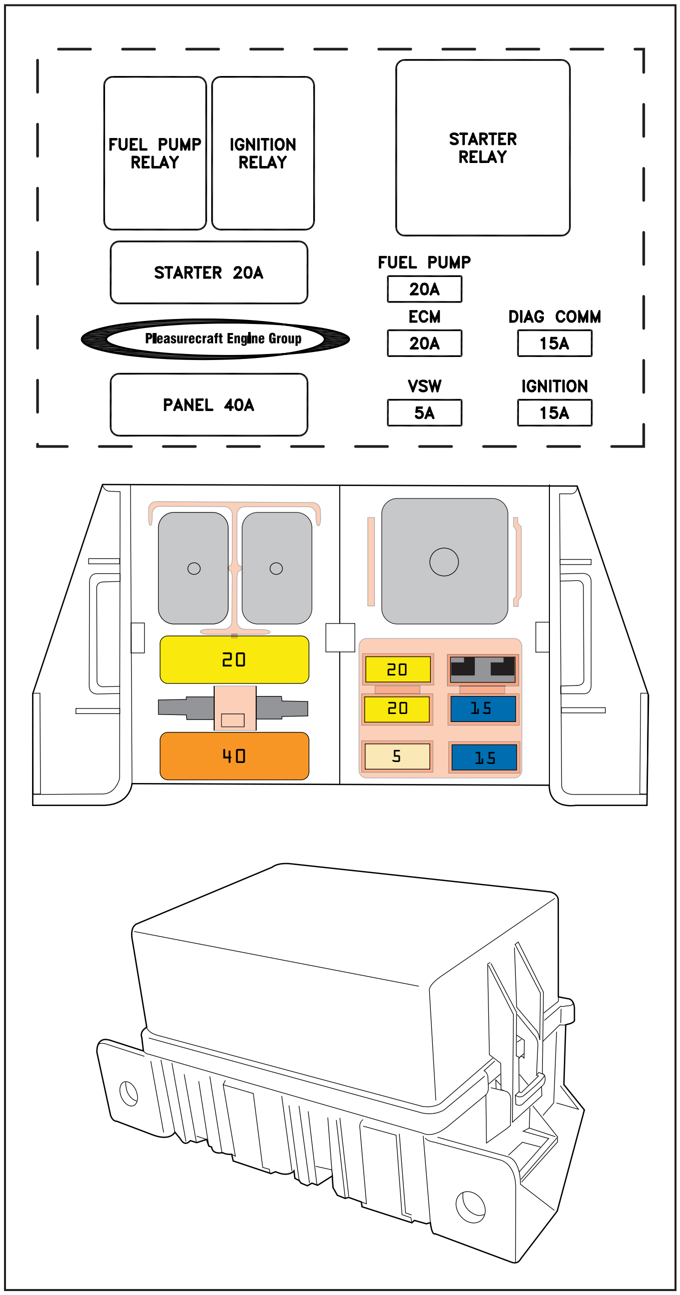


Figure 11-6 Electrical System Relay and Fuse Block

BATTERY

WARNING

Battery electrolyte is a corrosive acid and should be handled with care. If electrolyte is spilled or splashed on any part of the body, IMMEDIATELY flush the exposed area with liberal amounts of water and obtain medical aid as soon as possible. Safety glasses and rubber gloves are recommended when handling batteries or filling with electrolyte.

WARNING

Hydrogen gases that escape from the battery when charging are highly explosive. Do not use jumper cables and a booster battery to start the engine. Do not recharge a weak battery in the boat. Remove the battery from the boat and recharge in a well ventilated area away from fuel vapors, sparks and open flames.

Follow maintenance instructions and warnings as supplied by the battery manufacturer. If this information is not available, follow these guidelines for the proper battery care.

- Do not operate the engine with an open in the battery circuit, as this may cause damage to the alternator. Make sure that all connections are clean and secure.
- When removing the battery cables, always remove negative (-) cable first, and then remove the positive (+) cable. When installing battery cables, install the positive (+) cable first, then install the negative (-) cable.
- Periodically check the battery for signs of corrosion, frayed battery leads or cracked case. Repair or replace as necessary.
- Periodically check the electrolyte level. Add distilled water to bring up to the proper levels.

IMPORTANT: Your engine is designed to work with the standard electronics installed in your boat. If you add other electrical components or accessories, you could change the way the fuel injection controls your engine or the overall electrical system functions. Before adding electrical equipment, consult your dealer. If you don’t, your engine may not perform properly.

CAUTION

Add-on equipment may adversely affect the alternator output or overload the electrical system. Any damage caused as a result will not be covered by, and may void, your warranty.

FRESH-WATER COOLING SYSTEM SACRIFICIAL ZINC ANODE

Located in the raw water side of the heat exchanger is a zinc anode which is marked by a decal. To check, remove the plug and visually check the condition of the zinc rod. The length of the zinc rod when new is approximately 1.5 inches. If more than one half of the zinc is gone, replace with a new zinc anode.

Different geographic locations and water make-up can result in either high or low sacrificial requirements. A high rate of zinc anode consumption should also alert the owner to a possibility of an improperly wired boat accessory, which would require complete checking by qualified service personnel.

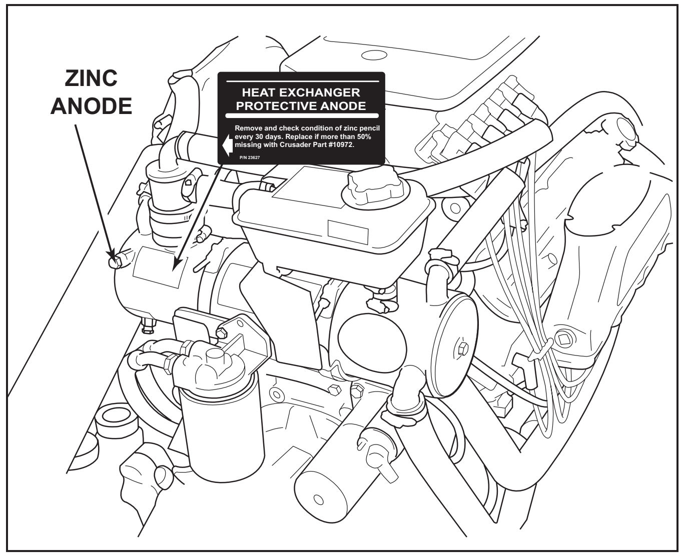


Figure 11-7 Zinc Anode Location 8.1L F.W.C. Heat Exchanger

CHECKING COOLANT LEVEL

WARNING

Do not remove cooling system filler cap when the engine is hot. Allow the engine to cool and then remove the pressure cap slowly, allowing the pressure to vent. Hot coolant, under pressure, may discharge violently and cause severe burns.

Degas Bottle

The "see-through" degas bottle is connected to the heat exchanger by a small hose. The degas bottle collects coolant that expands with rising temperature, and would otherwise overflow from the system. Coolant level should be at or slightly above the "ADD" mark on the bottle when the system is cold. Coolant should be added ONLY to the bottle when the system cools.

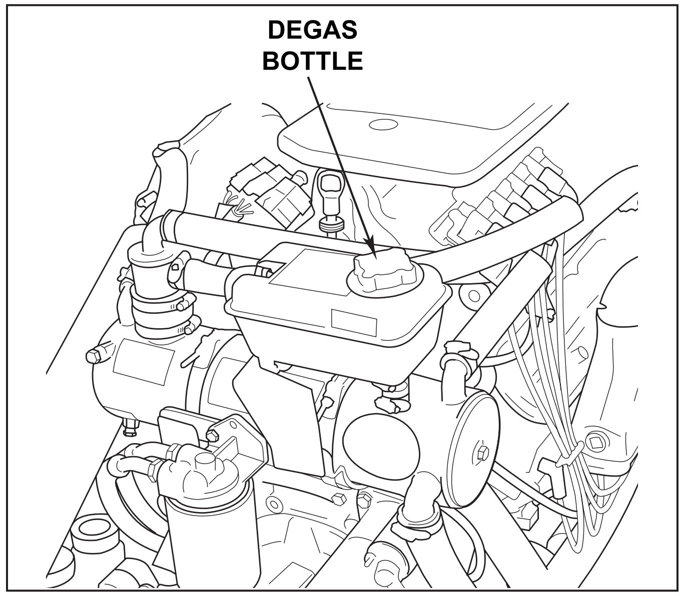


Figure 11-8 Checking Coolant Level (6.0L)

FLUSHING COOLING SYSTEM - SEA-WATER SECTION

To prevent silt and/or salt build-up in the cooling system (fresh or raw-water cooled), flush the sea-water section of the cooling system with fresh water at specified intervals.

CAUTION

Do not operate the engine without water being supplied to the sea-water pump. The sea-water pump impeller may be damaged and subsequent overheating damage may result.

CAUTION

Do not run the engine above 1500 RPM when flushing. Suction created by the sea-water pump may collapse the flushing hose, causing the engine to overheat. Watch the temperature gauge while flushing to ensure the engine does not overheat.

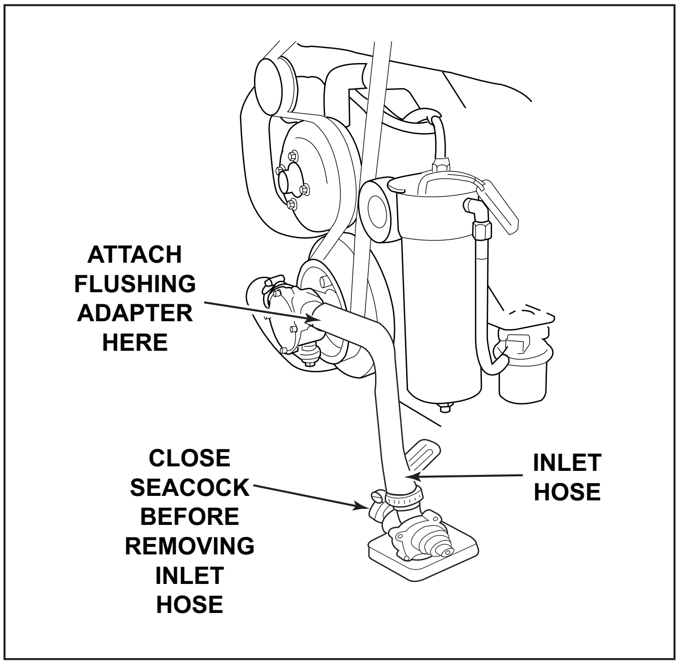


Figure 11-9 Typical Sea-Water Inlet

TESTING COOLANT FOR ALKALINITY

It is recommended that the coolant in the fresh-water section be tested each year for alkalinity. Coolant that is not alkaline has lost the effectiveness of its rust inhibitors, which can lead to internal corrosion and cooling system problems. It is recommended to replace the extended life engine coolant, known as DEX-COOL™, in the system every five years to prevent a build-up of harmful chemicals within the fresh-water system.

1. Obtain red litmus paper from a local supplier (drugstore, laboratory, etc.).
2. Remove the pressure cap from the coolant filler neck and insert one end of the litmus paper into the coolant.
3. If red litmus paper turns blue, coolant is alkaline and does not need to be replaced. If the litmus paper remains red, the coolant is not alkaline and must be replaced.

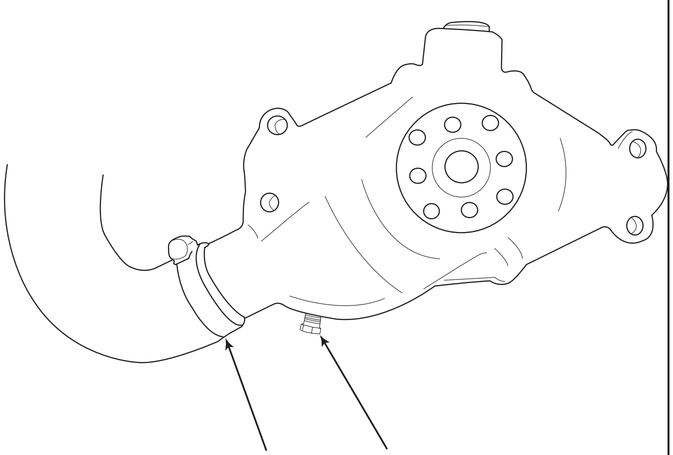


Figure 11-10 Draining Engine Circulating Pump (5.0/5.7L)

DRAINING FRESH-WATER COOLING SYSTEM

NOTICE: To protect the environment, dispose of coolant properly. Check your local restrictions for proper disposal instructions of removed coolant.

NOTICE: Refer to cooling system water flow diagrams for drain locations.

1. Remove the following drain plugs to drain coolant from the fresh-water cooling system:
   - Drain plug on heat exchanger
   - The hose and/or drain plugs from the fitting on the bottom of the exhaust manifolds (one on each side)
   - Drain plugs from risers
   - Drain plugs on the cylinder block (one on each side)
   - <u>Remove the large hose from the engine block water circulating pump, or drain plug on circulation pump.</u> (See Figure 11-10.)
2. Remove the following drain plugs to drain raw water from the fresh-water cooling system:
   - Drain plug on oil cooler
   - Drain plug on heat exchanger
   - Drain plug on fuel cooler canister (returnless fuel system only)
3. After system has drained completely, coat all the drain plugs with PerfectSeal (or equivalent) and reinstall in the proper locations. Reinstall the hose(s) on the water circulating pump and the exhaust manifolds and tighten the clamps securely.

FILLING FRESH-WATER COOLING SYSTEM

A new extended life engine coolant known as DEX-COOL™ is used in your engine(s). It is imperative to note the following about DEX-COOL™ engine coolant:

- IT IS PINK IN COLOR TO DISTINGUISH IT FROM CONVENTIONAL COOLANT.
- THE SERVICE CHANGE INTERVAL ON ENGINES BUILT WITH DEX-COOL™ IS 5 YEARS.
- TO MAINTAIN FULL CORROSION PROTECTION DURABILITY, DEX-COOL™ MUST NOT BE MIXED WITH CONVENTIONAL (CONTAINING SILICATE) ENGINE COOLANTS.
- DEX-COOL™ IS AN ETHYLENE GLYCOL BASED PRODUCT, THEREFORE, BOIL AND FREEZE PROTECTION ARE MEASURED IN THE SAME FASHION AS CONVENTIONAL COOLANTS.

TO FULLY REALIZE ITS MANY ADVANTAGES, DEX-COOL™ MUST NEVER BE MIXED WITH CONVENTIONAL COOLANTS.

DEX-COOL™ can become contaminated by inadvertently topping-off with conventional coolant, adding conventional coolant to the system or even if fill/drain containers are shared between coolants. If contamination occurs, the cooling system must be immediately drained and flushed, and refilled with DEX-COOL™. No short-term damage will occur, however, the service interval will be reduced from 5 years to 2 years.

The fresh-water cooling side of the cooling system must be filled with a 50/50 mixture of DEX-COOL™ (or equivalent, which meets GM6277M) extended life antifreeze and water solution.

IMPORTANT: More than 50% antifreeze solution can contribute to an overheating condition.

IMPORTANT: If the engine is being placed in winter storage, the fresh-water cooling section must be filled with a correct type of coolant and water solution, properly mixed, to protect the engine to the lowest temperature to which it will be exposed.

1. Make sure that all drain plugs are properly installed.
2. Remove the pressure cap from the Degas Bottle.
3. Fill the system with antifreeze solution until the system is filled. See ENGINE FLUID CAPACITIES for system capacities.
4. Start the engine and operate at idle speed (1200-1500 RPM) to purge any air from the system.
5. Add additional coolant into the Degas Bottle to the “MAX” level. When the coolant level remains constant in the Degas Bottle, install the pressure cap.
6. Continue to run the engine until it reaches normal operating temperature. Check the Degas Bottle for the proper level and add coolant if necessary, after the engine cools.

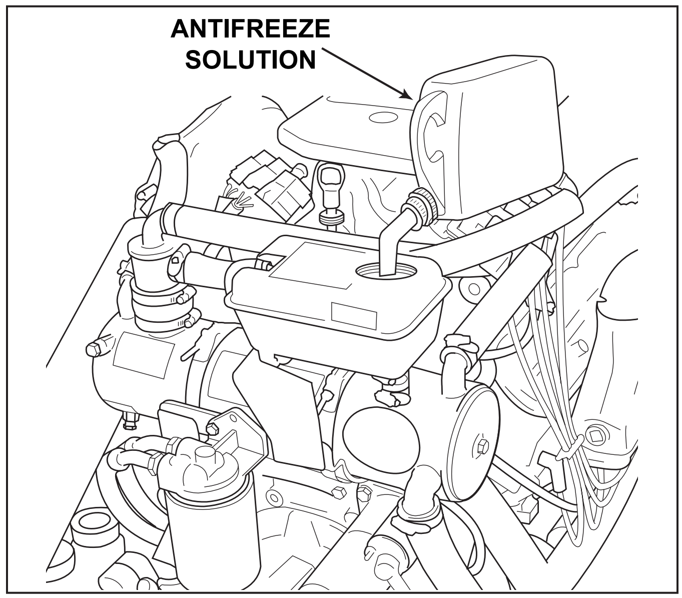


Figure 11-11 Filling F.W.C. System (6.0L) (Typical)

CLEANING SEA-WATER SECTION OF HEAT EXCHANGER - FRESH-WATER COOLED MODELS ONLY

The sea-water section of the heat exchanger should be cleaned whenever there is a noticeable decrease in cooling efficiency. You may use the following procedure for cleaning, or, if the build-up of scale and mineral deposits is heavy, it is recommended that the heat exchanger be removed and taken to a repair facility to be boiled out (such as a radiator repair facility).

1. Remove the bolts securing the heat exchanger end plates. Remove the end plates and gaskets.
2. Clean the water passages in the heat exchanger by inserting a suitable-size wire brush into each passage. Use compressed air to blow out loose particles.
3. Clean the gasket surfaces on the end plates and the heat exchanger. Apply PerfectSeal to both sides of the new gaskets. Install the end plates and the new gaskets onto the heat exchanger. Install the bolts and tighten securely.
4. Start the engine and inspect for leaks.

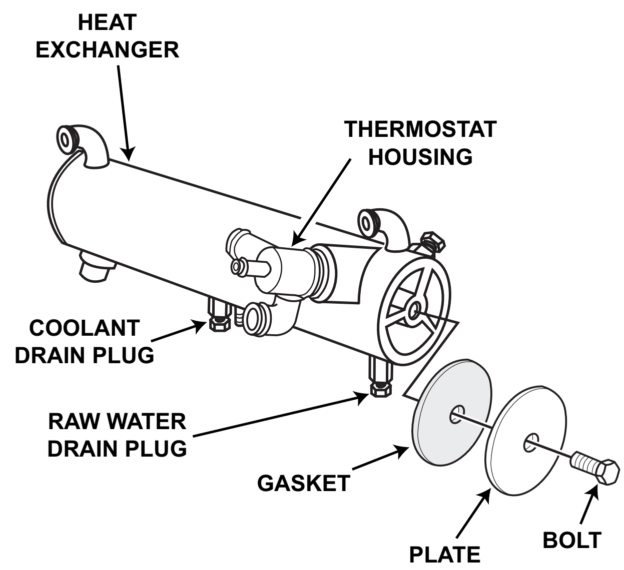


Figure 11-12 Heat Exchanger and End Plate Removal (Typical)

FUEL SYSTEM DESCRIPTION

Crusader Marine Engines will be equipped with one of two fuel systems: The Fuel Control Cell (FCC), "Return" or "Returnless-Type."

The "Return-Type" fuel system is best described as having a fuel feed line coming from the fuel tank and fuel line that returns unused fuel back to the fuel tank.

The "Returnless-Type" fuel system requires a fuel feed line to supply fuel. Excess fuel, not used by the engine, is circulated through the FCC bowl.

WARNING

Extreme caution must be exercised when servicing the fuel system and/or replacing fuel filter. Gasoline is extremely flammable and highly explosive under certain conditions. Be sure the ignition key is off and do not smoke or allow open flame in the area while servicing. Wipe up any spilled fuel immediately.

WARNING

Accumulation of water and other fuel contaminants may form corrosive compounds that can damage the fuel filter, and result in fuel leakage. Ethanol blended fuel may increase this risk. For this reason, annual replacement of the fuel filter, at a minimum, is required to avoid risk of explosion or fire.

WARNING

Extreme caution must be exercised when servicing the fuel system. The fuel system operates under high pressure. Use caution when removing or replacing components, as residual pressure may be present.

WARNING

Make sure that there are no fuel leaks before closing the engine hatch.

WARNING

Visually inspect unit for fuel leaks before operating the engine. If fuel leaks are present, DO NOT operate the engine, contact your Crusader Premier service center immediately.

Fuel Control Cell (FCC) Fuel System

The Fuel Control Cell (FCC) eliminates vapor lock and air ingestion caused by fuel tank slosh, and provides the necessary filtration and water separation.

The FCC system incorporates two (2) fuel pumps to provide an uninterrupted flow of fuel to your Crusader marine engine. Fuel is fed into the FCC bowl by a low-pressure, high-volume electric fuel pump. This pump flows fuel at a volume much greater than the fuel flow rate required of the high-pressure pump and engine demands. The high-pressure pump, mounted inside the FCC bowl, provides the necessary fuel pressure and volume to maintain proper engine performance. The FCC constantly has an ample supply of fuel to meet the idle, cruise and acceleration fuel requirements of the engine.

The fuel pressure regulator, located on the fuel rail, controls the fuel pressure, and maintains a constant pressure across the fuel delivery system. 6.0L and 8.1L engines' fuel pressure regulator is located inside the FCC, therefore, they do not require a fuel return line from the fuel rail. Excess fuel, not used by the engine, returns to the FCC bowl.

The fuel delivered to the engine by the FCC is filtered by a filter and water separator element, which surrounds the high pressure pump inside the FCC bowl.

As indicated above, fuel enters the FCC bowl from two (2) locations, the low-pressure pump (initial input) and the fuel pressure regulator (unused, recirculating fuel). Fuel exits the FCC bowl at two (2) locations (Return-Type fuel system, only), the high-pressure output to the fuel injection system and all excess fuel in the FCC bowl is routed back to the tank via the return line.

Servicing the FCC

The frequency of draining the water or replacing the filter element is determined by the contamination level of the fuel. Replace the filter element at least once a year, or when a loss of power is noticed (whichever occurs first).

WARNING

This unit should only be serviced by a qualified Crusader Premier technician. Improper use, installation or servicing may cause an explosion or fire resulting in bodily injury, or death. Read and follow all instructions before proceeding. Run the engine and check for fuel leaks after installation, element replacement or draining the bowl. DO NOT remove the FCC bowl unless servicing the filter element, otherwise contamination or bowl O-ring swelling may result.

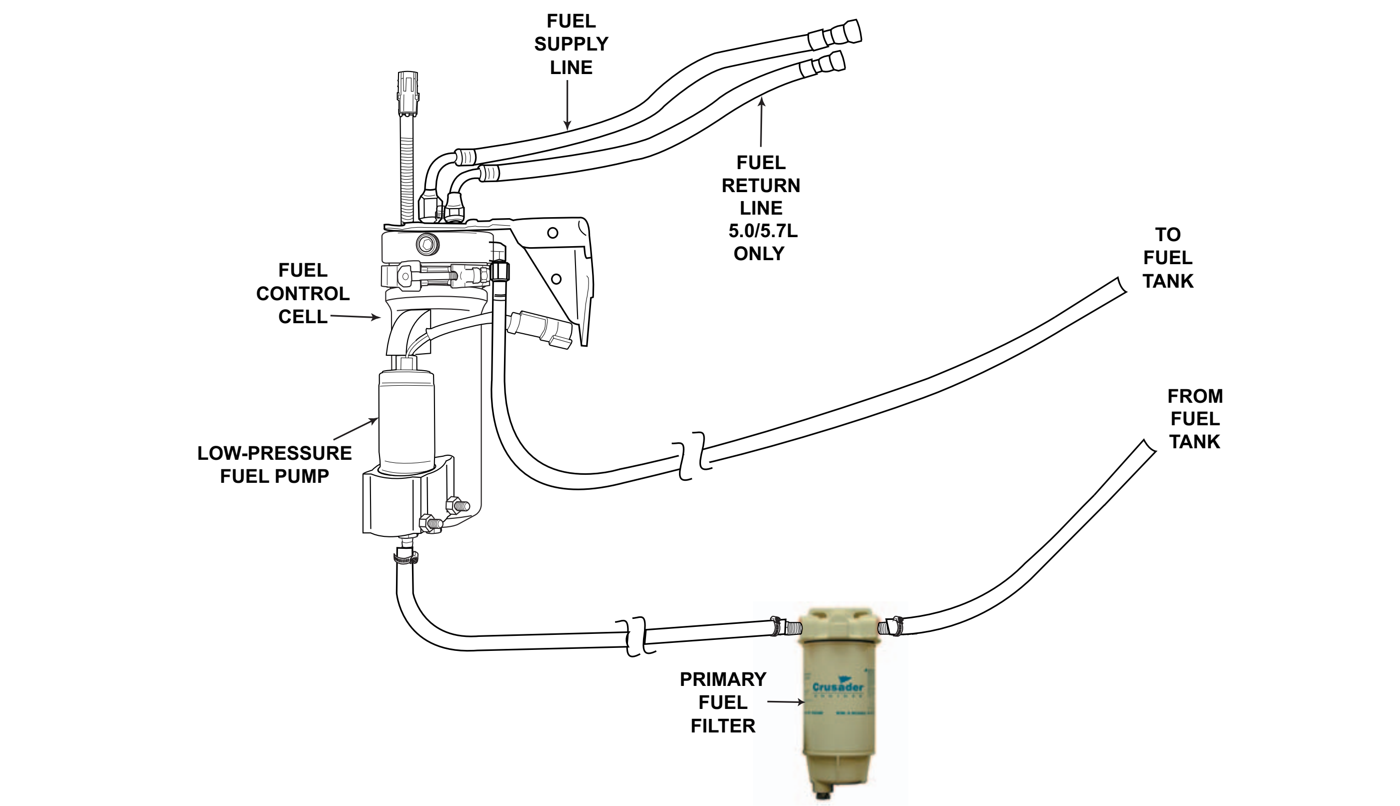


Figure 11-13 Fuel Control Cell (FCC) Fuel System - Return-Type (Typical)

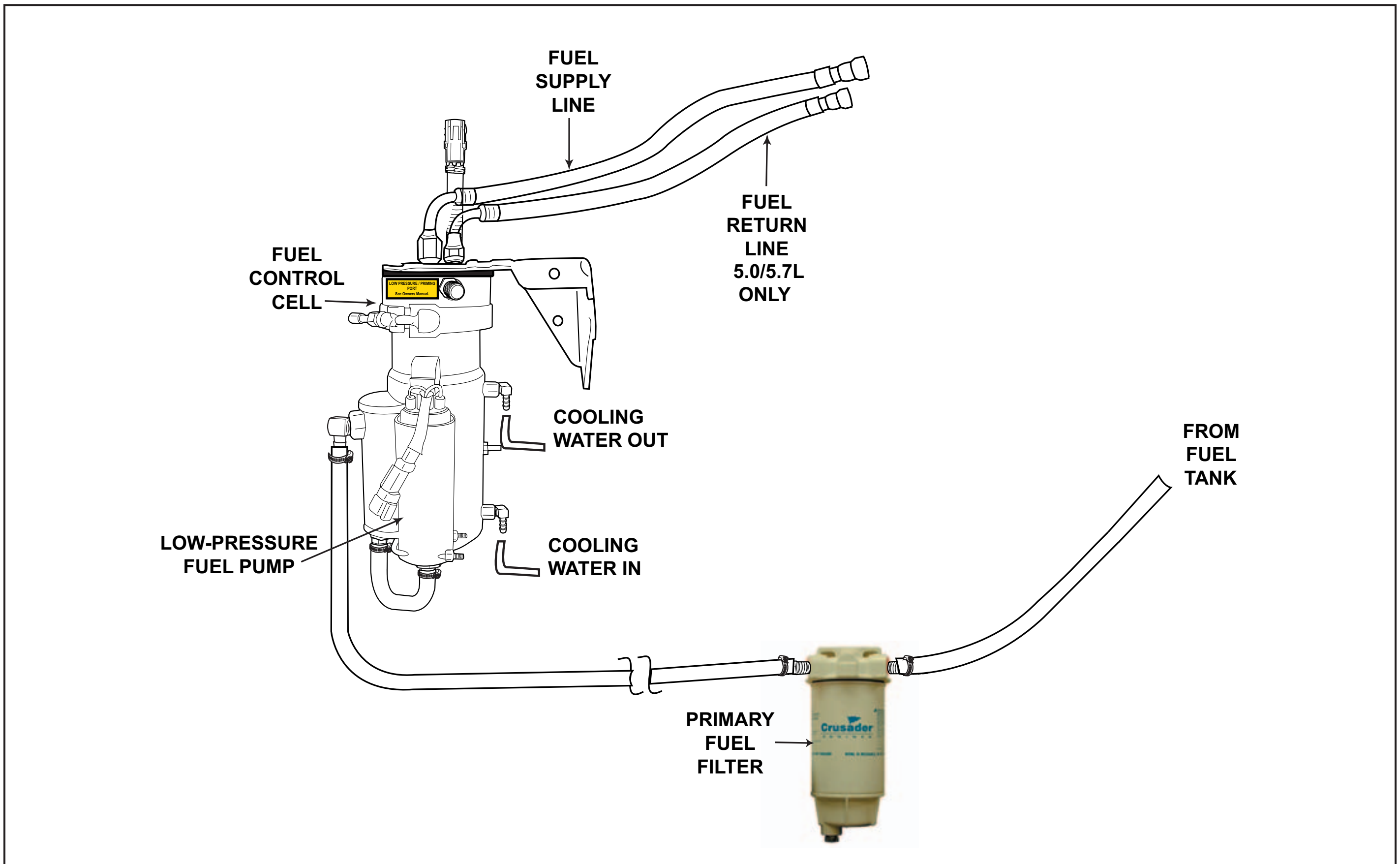


Figure 11-14 Fuel Control Cell (FCC) Fuel System -Returnless-Type (Typical)

FCC Service Instructions (FCC Clamp-on Canister)

> **WARNING**
>
> Extreme caution must be exercised when servicing the fuel system. The fuel system operates under high pressure. Use caution when removing or replacing components, as residual pressure may be present.

Draining the FCC Bowl, ENGINE OFF

1. Disconnect the two-wire electrical connectors from the FCC and the Low Pressure Fuel Pump (LPFP).
2. Remove the 7/16” plug, and drain the bowl contents into an approved container.

CAUTION: Both fuel and water will drain from the FCC bowl.

3. Apply pipe sealant, suitable for use with gasoline, to the threads of the 7/16” plug.
4. Tighten the 7/16” plug.
5. Reconnect the two-wire electrical connectors to the FCC and LPFP.
6. Cycle the ignition key several times to run the electric fuel pumps and fill the FCC bowl with fuel. Inspect the drain plug area for leaks. Correct any leaks prior to operating the engine.
7. Start the engine and inspect for fuel leaks. Correct any leaks prior to operating the engine any further.

Filter Element Replacement, ENGINE OFF

FCC SERVICE KIT#: RP080026

1. Disconnect the two-wire electrical connectors from the FCC and the Low Pressure Fuel Pump (LPFP).
2. Disconnect the fuel supply line from the LPFP.

> **WARNING**
>
> ***Residual fuel will leak from the pump and the supply line. Elevate and plug the supply line to minimize fuel leakage. Capture/clean-up spilled fuel as required. Dispose of shop towels in an approved container.***

3. Remove the 7/16” plug, and drain the bowl contents into an approved container.

CAUTION: Both fuel and water will drain from the FCC bowl.

4. Remove the canister retaining clamp.
5. If equipped, remove water supply (bottom) and discharge (top) hoses from the canister. Disconnect bonding wire attached to canister.
6. Slide the canister downward over the suspended filter element. It may be necessary to pull the unit to one side in order to remove.
7. Remove the fuel filter element from the suspended pump by gripping the fuel pump with one hand, and pulling the filter element downward with the other hand.
8. Visually inspect all internal components, i.e. hoses, wires, etc.
9. Push on new filter element (part number RP080026) over the electric fuel pump.
10. Using a pick made of soft material, such as a toothpick, remove the old O-rings from the FCC head.

CAUTION: The mounting head O-ring grooves may be damaged by using sharp steel tools to remove this O-ring.

CAUTION: Use only fuel approved O-rings (R047241) provided in RP080026 Kit. Use of non-approved O-rings may cause fuel to leak from the FCC.

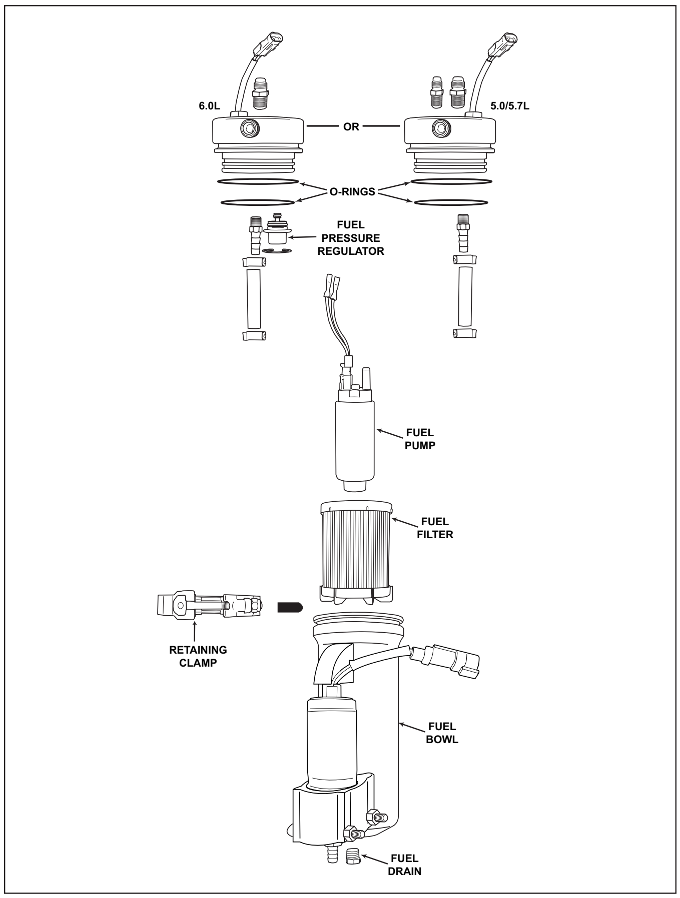


Figure 11-15 Fuel Control Cell (FCC) - Clamp-on Canister (Typical)

11. Install the new O-rings in the same location. Lubricate the new O-rings with a fuel resistant O-ring lubricant.
12. Apply pipe sealant, suitable for use with gasoline, to the threads of the 7/16” plug.
12. Install and tighten the 7/16” plug into the canister.
13. Install the canister firmly back onto the FCC head.
14. Reinstall the retaining clamp and tighten securely.
15. Reconnect the fuel supply line to the LPFP.
16.. If equipped, re-install water supply (bottom) and discharge (top) hoses to the canister. Connect bonding wire to canister.
17. Reconnect the two-wire electrical connectors to the FCC and the LPFP.
18. Cycle the ignition key several times to run the electric fuel pumps and fill the FCC bowl with fuel. Inspect the drain plug area for leaks. Correct any leaks prior to operating the engine.
19. Start the engine and inspect for fuel leaks. Correct any leaks prior to operating the engine any further.

DO NOT ATTEMPT TO SERVICE ANY OTHER PARTS ON THIS UNIT.

WARNING

Extreme caution must be exercised when servicing the fuel system. The fuel system operates under high pressure. Use caution when removing or replacing components, as residual pressure may be present.

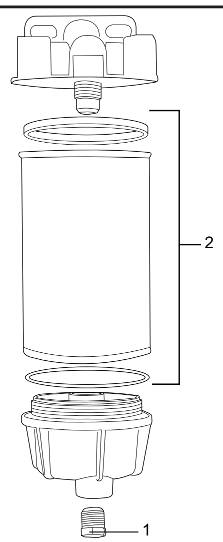


Figure 11-16 Primary Fuel Filter

Primary Fuel Filter

Primary Fuel Filter Element#: R080033

To Drain Contaminants:

Draining the collection bowl: water is heavier than fuel and will settle to the bottom of the bowl and appear different in color. In extremely humid conditions, take a fuel sample (in a clear container) frequently, daily, if needed and drain as required if water is present.

1. Place a suitable container below the unit to collect the contaminants.
2. Close the fuel tank valve (if applicable), then loosen/remove the drain plug (1) at the bottom of the bowl. Figure 11-16 item 1.
3. Prime the fuel system following the instructions under Priming the Fuel System.

To Replace the Element:

Element replacement frequency is determined by the contamination level in fuels. Fuel flow to the engine becomes restricted as the element slowly plugs with contaminants, resulting in noticeable power loss and/or hard starting. Replace element annually, every 500 hours or when there is a noticeable power loss, whichever comes first. Change the element as soon as possible. *Always carry extra replacement elements as one tank full of excessively contaminated fuel can plug a fuel filter.*

Clean any debris or dirt away from the Crusader head/filter joint prior to removal.

1. Place a suitable container below the unit to collect the contaminants.
2. Close the valve at the fuel tank (if applicable) and then remove the drain plug (1) to empty the filter of fuel.
3. Spin the Element and Bowl off together (use a strap wrench on the element), then remove the bowl from the element (2). Figure 11-16 item 2.
4. Clean the bowl O-ring gland and the sealing surface of the mounting head free of dirt, debris or gums.
5. Apply clean motor oil to the new seal and to the bowl O-ring supplied with the new element.
6. Place the new seal onto the top of the new element and the O-ring into the bowl gland.
7. Spin the bowl onto the element, and then fill the element and bowl assembly with clean fuel.
8. Spin the bowl and element onto the head. Tighten snugly by hand - *do not use tools.*
9. Prime the fuel system following the instructions under Priming the Fuel System.

WARNING

Make sure there are no fuel leaks before closing the engine hatch.

Priming Fuel System

To prime the fuel system, cycle the ignition key 3 times using the following procedures:

1. Turn ignition key to ON position for 5 seconds.
2. Turn ignition key OFF.
3. Pause for 10 seconds.
4. Repeat steps 1-3 three times.

Crank the engine until it starts or 30 seconds elapse. If the engine does not start, repeat the priming procedures.

WARNING

This unit should only be serviced by a qualified Crusader Premier technician. Improper use, installation or servicing may cause an explosion or fire resulting in bodily injury, or death. Read and follow all instructions before proceeding. Run the engine and check for fuel leaks after installation, element replacement or draining the bowl. DO NOT remove the FCC bowl unless servicing the filter element, otherwise contamination or bowl O-ring swelling may result.

If you have performed steps 1-4 above, have a 'Returnless' fuel system, and are unable to achieve prime of the fuel system, you will need to have your Crusader Premier technician perform the following additional steps to prime the fuel system.

Refer to Figure 11-17.

5. Ensure Primary Fuel Filter is filled with fresh fuel. Refer to Primary Fuel Filter procedure on page 55.
6. Connect a Fuel Pressure Gauge to the Low Pressure/Priming Port on the FCC.
7. Place the Fuel Pressure Gauge pressure relief hose into an approved container. Open the Fuel Pressure Gauge Pressure Relief Valve.
8. Cycle the ignition key to the ON position for 5 seconds then OFF for 10 seconds. Repeat this sequence until fuel flows through the Fuel Pressure Gauge into the approved container.
9. Close the Pressure Relief Valve on the Fuel Pressure Gauge. Disconnect the Fuel Pressure Gauge and properly dispose of the recovered fuel.
10. Refer to the engine starting procedure, page 28.

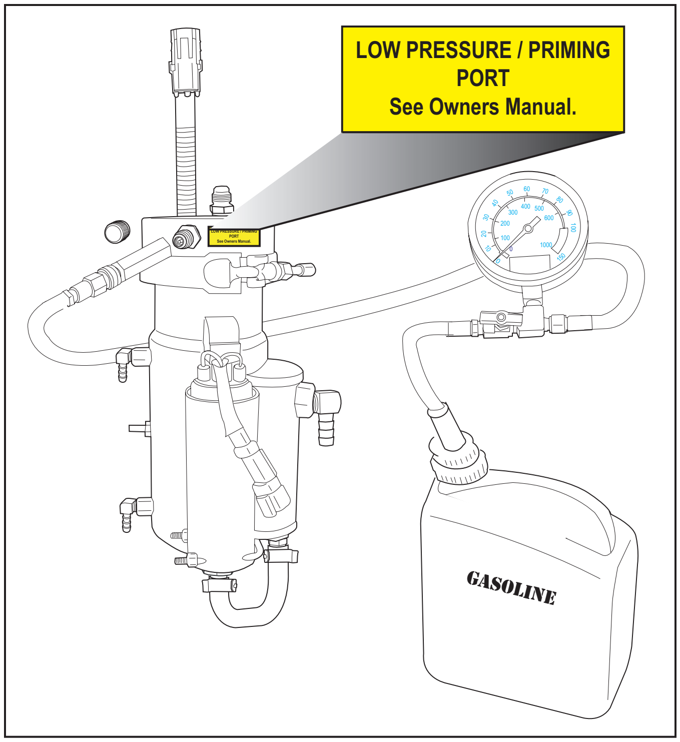


Figure 11-17 Priming Port

WARNING

Make sure there are no fuel leaks before closing the engine hatch.

FLAME ARRESTOR

At specified intervals, the flame arrestor should be checked for blockage caused by dirt or other foreign material.

Loosen the clamp securing the flame arrestor to the air intake tube or throttle body. Remove the flame arrestor. Clean the flame arrestor with solvent and dry with compressed air. Reinstall the flame arrestor and tighten the clamp(s) securely.

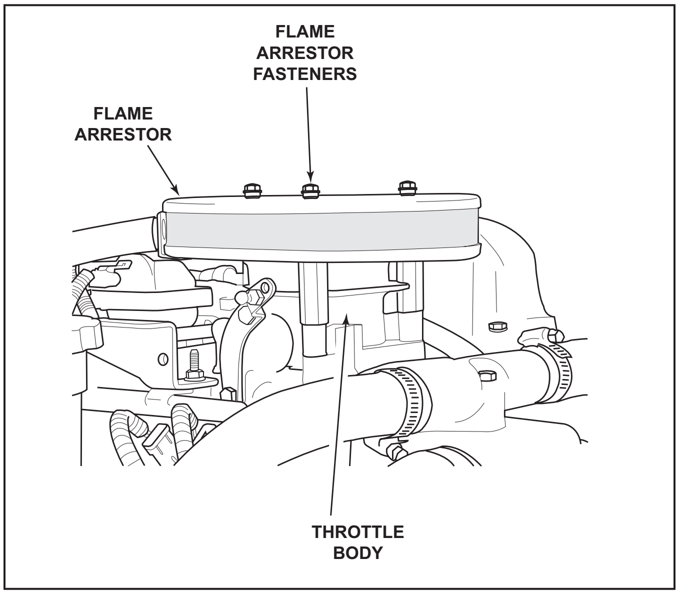


Figure 11-18 Flame Arrestor - 5.7L (Typical)

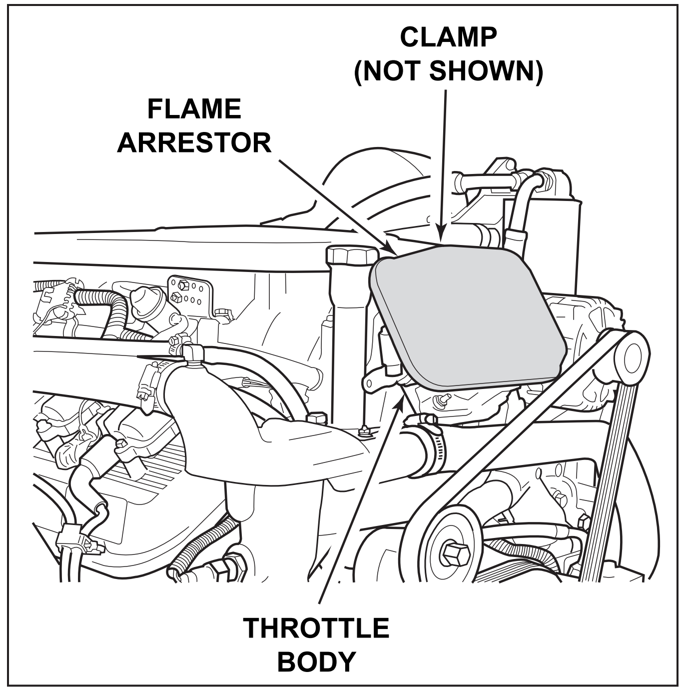


Figure 11-19 Flame Arrestor - 8.1L (Typical)

DRIVE BELT INSPECTION

Inspect the drive belt for excessive wear, shredding or missing sections.

Inspect the drive belt for contamination from excessive dirt, oil, coolant or other substances that may effect the drive belt operation.

If a problem is found, replace the belt after inspecting the following items:

- The engine water circulation pump and alternator pulleys for signs of misalignment
- The engine water circulation pump and alternator pulleys for signs of rust or other damage
- Bent pulleys or tight bearings in the engine water circulation pump and alternator

ACCESSORY DRIVE BELT

The Crusader engines use a single serpentine belt to drive the engine water circulation pump, sea-water pump and the alternator.

DRIVE BELT REPLACEMENT

8.1L SERPENTINE BELT #: R066024A

6.0L SERPENTINE BELT #: R066033

5.0/5.7L SERPENTINE BELT (LH) #: R066028

5.0/5.7L SERPENTINE BELT (RH) #: R066029A

1. Note the routing of the belt before removing.
2. Using a 15 mm box wrench or socket, turn the belt tensioner to relieve the tension on the belt. Slide the belt off of the pulleys. ***Release the tensioner slowly to prevent the tensioner from snapping against its stop, and possibly causing damage to the tensioner.***
3. Slide the new belt onto the pulleys using the same routing as noted prior to removal.
4. Compress the belt tensioner, and slide the belt over the tensioner pulley. Release the tension slowly to tension the belt.

SERVICING RAW WATER PUMP IMPELLER

IMPELLER KIT #: RP061022

The raw water pump impeller should be serviced every 50 hours, or once a year, whichever occurs first. See Maintenance Schedule.

Locations “A” (refer to belt configurations) are access holes in order to loosen the raw water pump housing attaching bolts. The bolts are secured in the pump by O-rings, and will not fall out during removal.

Torque the raw water pump housing attaching bolts to 8.5-9 ft.lbs. (11.5-12 N-M), when re-installing the impeller.

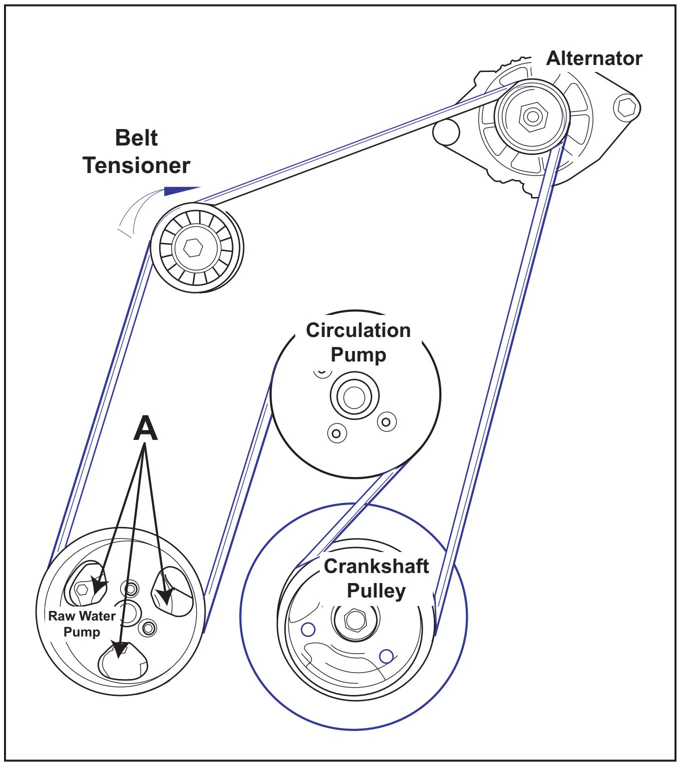


Figure 11-20 8.1L Accessory Drive Belt Configuration

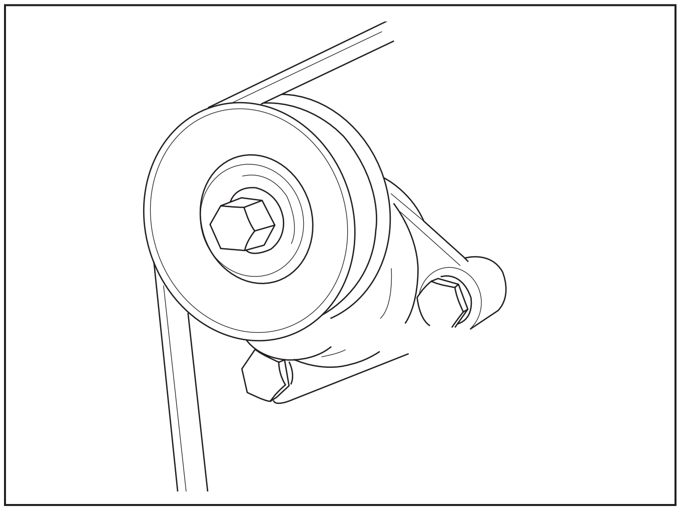


Figure 11-21 Belt Tensioner (8.1L)

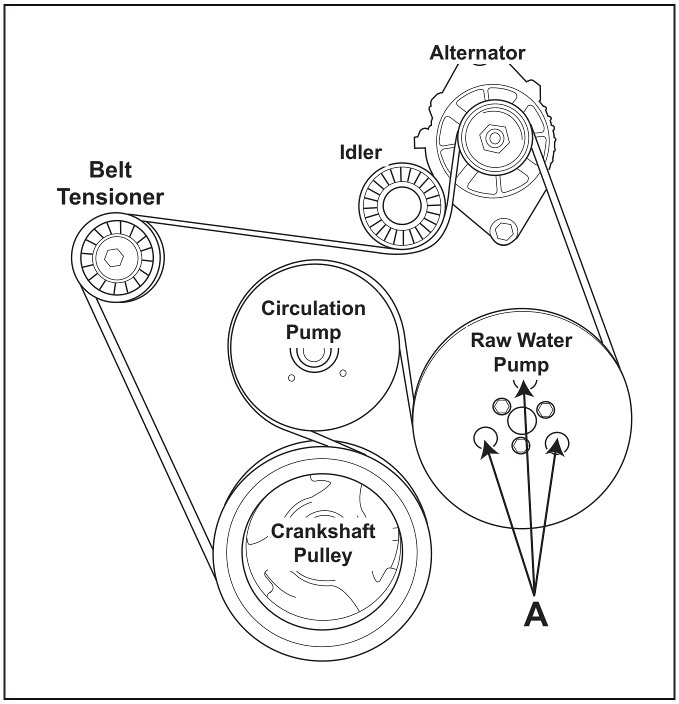


Figure 11-22 6.0L Accessory Drive Belt Configuration

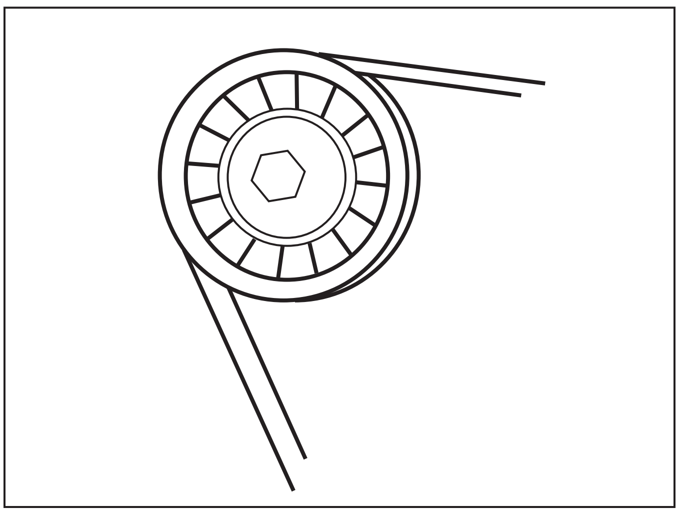


Figure 11-23 Belt Tensioner (6.0L)

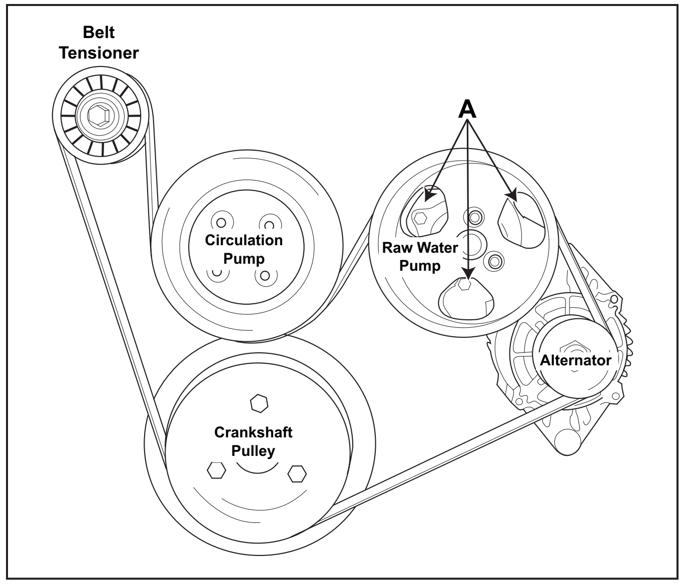


Figure 11-24 5.7L Accessory Drive Belt Configuration (Left Hand Rotation)

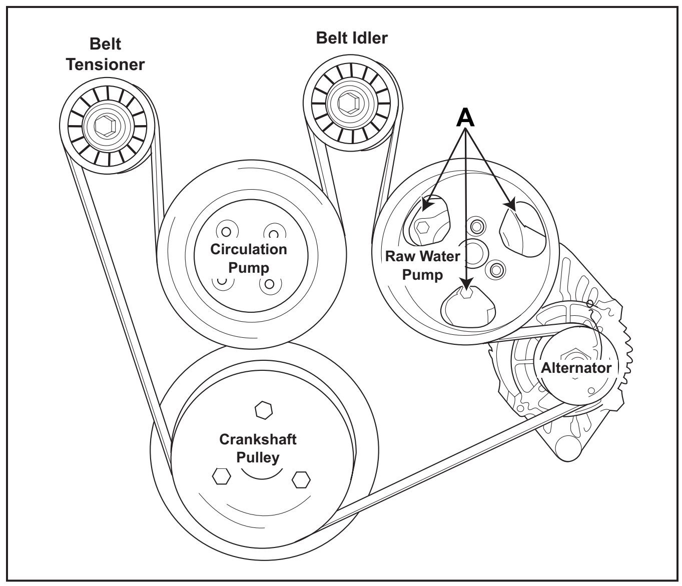


Figure 11-24A 5.7L Accessory Drive Belt Configuration (Right Hand Rotation)

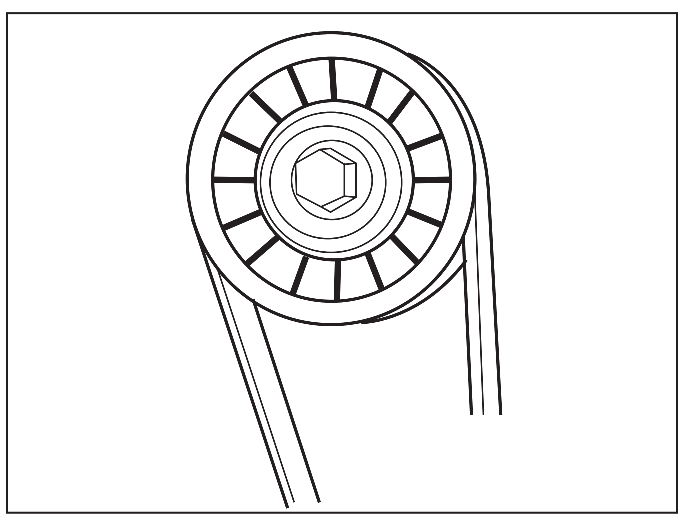


Figure 11-25 Belt Tensioner (5.0/5.7L)

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CHANGING OILS

WARNING

IMPORTANT: The Federal Water Pollution Control Act prohibits the discharge of oil or oily waste into or upon the navigable waters and continuous zone of the United States, if such discharge causes a film or sheen upon, or discoloration of the surface of the water, or causes sludge or emulsion beneath the surface of the water. Violators are subject to a penalty of $5,000.00.

Refer to the MAINTENANCE SCHEDULE for oil change intervals. The engine and transmission oils should be changed prior to placing the boat into storage.

The transmission oil change should be performed by an authorized Crusader Engines Premier dealer, at specified intervals.

IMPORTANT: Change the engine oil when the engine is warm from operation. Warm oil flows more freely, and allows more foreign material and impurities to be removed.

The engine oil filter is remote mounted. The engine block location, where the filter is normally mounted, is covered with an oil filter bypass adapter. DO NOT remove this adapter when changing the oil.

1. With the engine at normal operating temperature, remove the dipstick and install a crankcase oil pump onto the dipstick tube (Figure 11-26). Insert the discharge hose into a suitable container. Pump the oil from the engine until the crankcase is empty. Remove the oil pump from the dipstick tube.
2. Remove the oil filter by turning it counterclockwise, using an oil filter wrench if necessary. Discard the old filter and sealing ring.
3. Coat the sealing ring, on the new filter, with a light coating of clean engine oil. Install the oil filter securely by hand. DO NOT overtighten.
4. Fill the engine with the recommended oil through the oil fill location on the valve cover (Figure 11-27). See **OIL REQUIREMENTS** page 40 and **ENGINE FLUID CAPACITIES** page 67, respectively.
5. Start the engine and operate for 5 minutes to circulate the oil throughout the engine. Check entire system for leaks, especially around the oil filter.

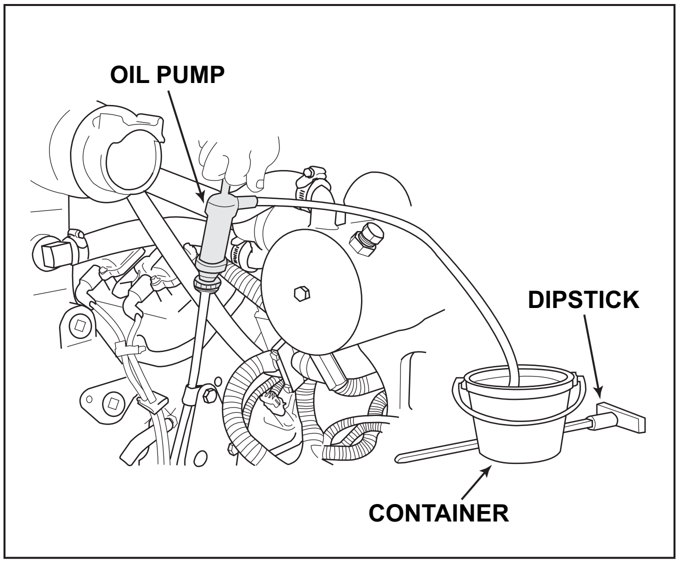


Figure 11-26 Engine Oil Removal

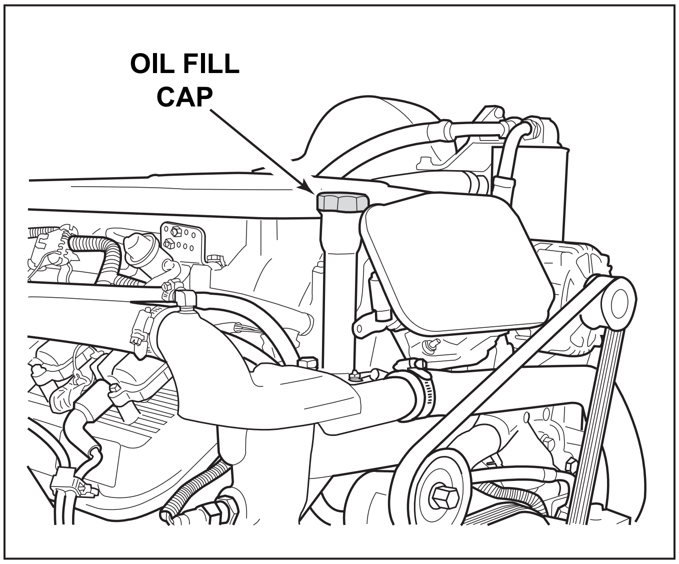


Figure 11-27 Engine Oil Fill (8.1L)

6. Stop the engine and wait 5 minutes to allow the oil to completely drain down. Check the oil level. Add or remove oil, as needed, to bring the engine oil to the proper level. See **CHECKING FLUID LEVELS** page 41 for Important Notes and Cautions to observe when checking the engine crankcase oil level.

ENGINE ALIGNMENT

CAUTION

Engine must be properly aligned, or vibration, noise and damage to the transmission output shaft oil seal and bearings may result.

IMPORTANT: Engine alignment MUST BE RECHECKED with the boat in the water, fuel tanks full and with a normal load on the boat. Engine must be aligned so that the transmission and the propeller shaft coupling center lines are aligned, and coupling faces are parallel within 0.003 in. (0.07 mm). This applies to installations with solid couplings, as well as flexible couplings.

1. Check the mating surfaces on the transmission and the propeller shaft couplings. Make sure they are clean and flat.

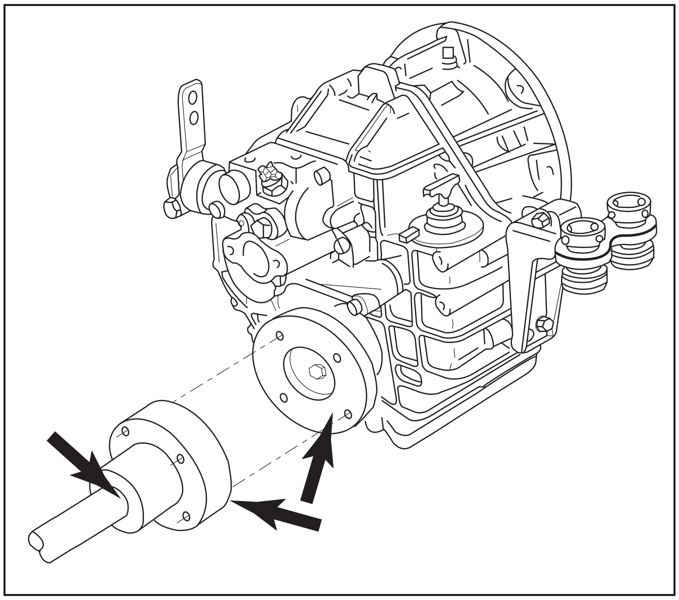


Figure 11-28 Shaft Mating Surface Check - 8 Degree Down Angle

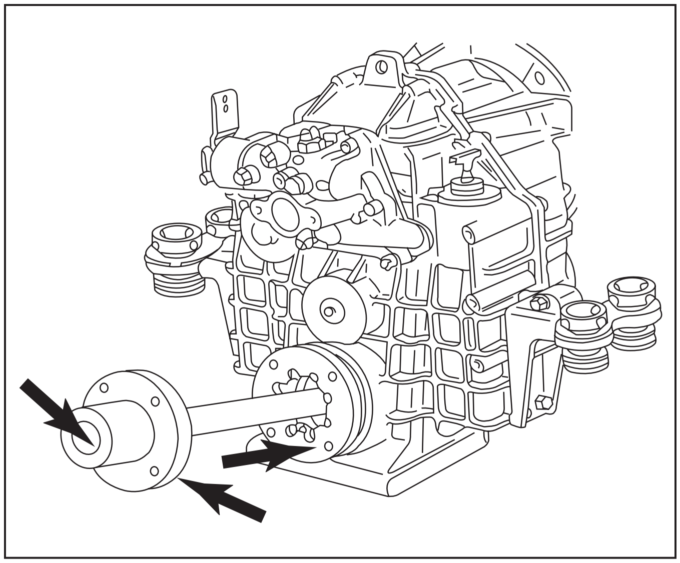


Figure 11-29 Shaft Mating Surface Check - “V” Drives

2. Center the propeller shaft in the shaft log as follows:

   - Push down and then lift the propeller shaft as far as it will move, then place the shaft in the middle of the movement.

   - Move the shaft to the port and then to the starboard as far as the shaft will move, then place the shaft in the middle of the movement.

   - With the propeller shaft in the middle of the shaft log, align the engine to the shaft.

3. Check that the coupling center lines align by butting the propeller shaft coupling against the transmission coupling. The shoulder on the propeller shaft coupling face should engage recessed on the transmission coupling face, with no resistance.

NOTICE: Some propeller shaft couplings may not have a shoulder on the mating surface. On these installations, use a straight edge to check the centerline alignment.

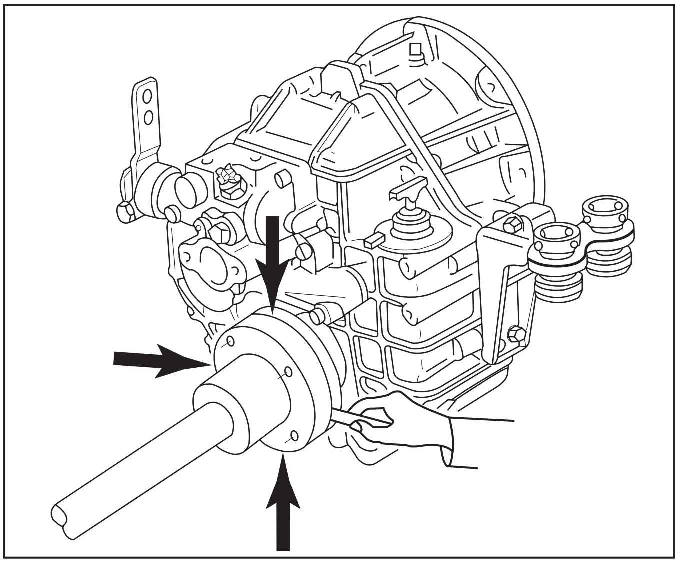


Figure 11-30 Centering Propeller Shaft - 8 Degree Down Angle

4. Check for any angular misalignment. Hold coupling faces tightly together and check for a gap between the coupling faces, with a 0.003 in. (0.07 mm) feeler gauge, at 90-degree intervals.

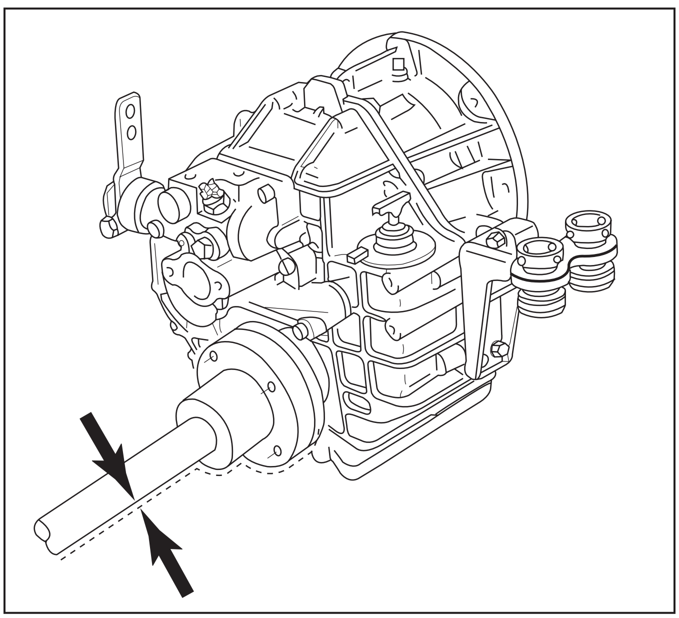


Figure 11-31 Angular Alignment - 8 Degree Down Angle

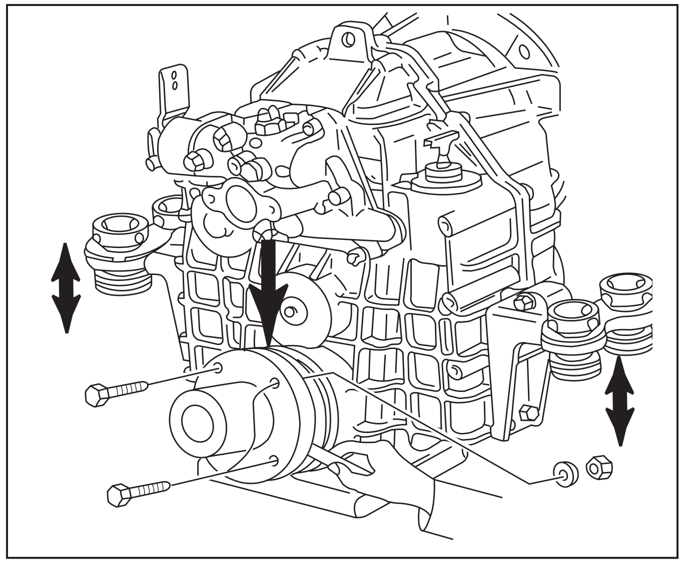


Figure 11-32 Angular Alignment - “V” Drives

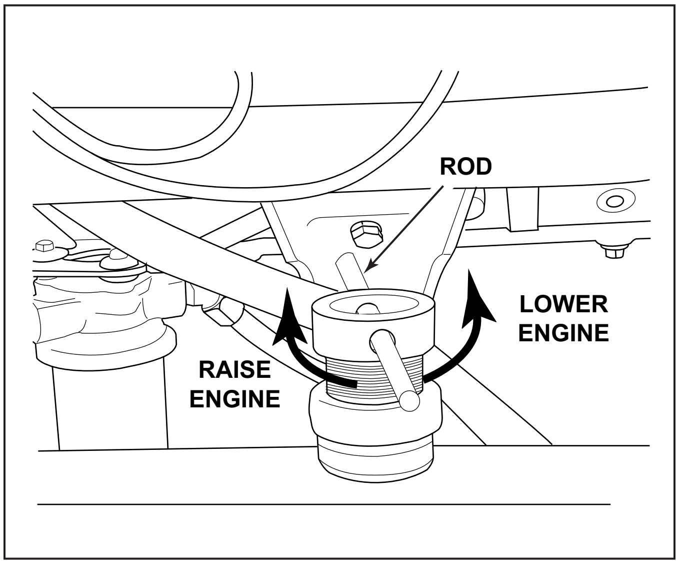


Figure 11-33 Engine Mount Adjustment

5. If the coupling center lines are not aligned, or if the coupling faces are more than 0.003 in. (0.07 mm) out of parallel, adjust the engine mounts as follows:

    - UP or DOWN ADJUSTMENT: Loosen the lag bolt 1/4 turn. Use the mount adjusting tool or a 3/8 in. (0.95 cm) or 1/2 (1.27 cm) diameter rod through both sides of the adjusting sleeve to turn. Turn the adjusting sleeve in the direction required to raise or lower the engine. After the adjustment is complete, tighten the lag bolt.

IMPORTANT: Both the front mount (or rear mount) adjusting sleeves must be turned equally to keep the engine level from side to side.

- LEFT or RIGHT ADJUSTMENT: Loosen the trunnion clamping bolt and the nut on all four mounting brackets. Move the engine to the left or right, as necessary, to obtain the proper alignment.

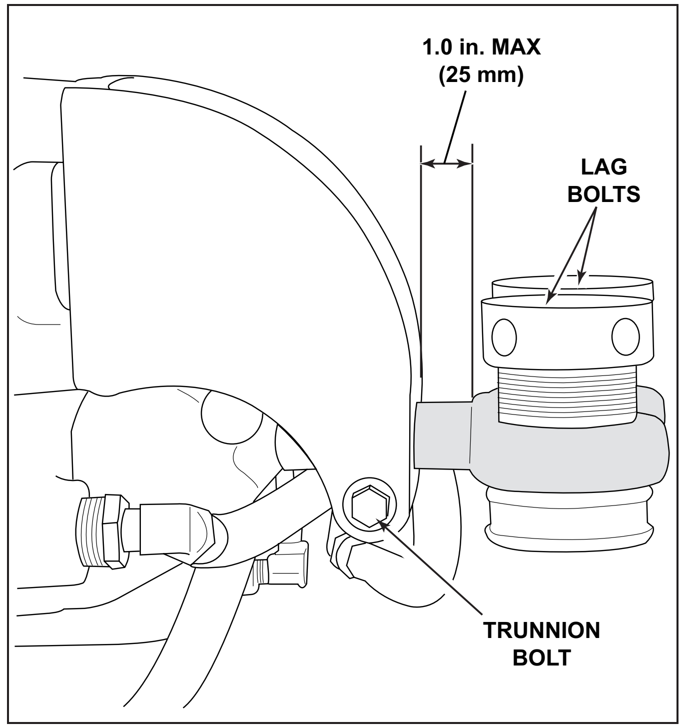


Figure 11-34 Engine Extension

IMPORTANT: The large diameter of the mount trunnion MUST NOT extend over 1.0 in. (25.4 mm) from the mounting brackets on any of the mounts.

6. After the engine has been properly aligned, secure the engine mounts.

7. Connect the propeller shaft coupling to the transmission coupling. Tighten the coupling attaching bolts and nuts to the correct specifications.

FASTENER TORQUE SPECIFICATIONS

Location	Lb-Ft (N·m)
Engine Mount to Stringer	Securely
Propeller	50 (68)
Trunnion Bolts	45 (61)

	ENGINE MAINTENANCE LOG	
Date	Maintenance/Repair	Operating Hours

MAINTENANCE SCHEDULE

Location and Service	Check Daily	After 1st 25 Hrs of Operation	Every 50 Hours of Operation	Every 100 Hours of Operation	Once Each Year
Check coolant level - Fresh-water cooled models only	X				
Check oil level - Engine crankcase	X				
Check oil level - Transmission	X				
Engine Assembly (complete - Check for obvious leaks (water, oil, fuel and exhaust)	X				
Remote Control and Steering System - Check for proper operation	X				
Sea Strainer - Check (if equipped)	X				
Cooling System - Check condition and tightness of all hose clamps		X		X[1]	X
Cooling System - Inspect/Replace raw water pump impeller				X	X
Drive Belt - Inspect condition and check tension		X		X	X
Exhaust System - Check condition and tightness of all hose clamps		X		X[1]	X
Exhaust System - Check for water leaks at the manifold, riser and elbow gaskets	X				
Ignition System and Spark Plugs - Clean and inspect condition		O		O	O
Engine Assembly (complete) - Check for loose, missing or damaged parts (especially engine mounts, starter and alternator mounting fasteners)		X		X	X
Change engine oil and filter		X	X		X
Engine Alignment - Check and adjust if necessary		O			O
Ignition Timing - Not Adjustable					
Battery - Check electrolyte level and specific gravity. Inspect case for damage. Check cables and connections.		X	X		X
Electrical System (complete) - Check for loose or dirty connections and damaged wiring			X[2]		X
Flame Arrestor and Crankcase Ventilation System - Clean and inspect				X	X

MAINTENANCE SCHEDULE (cont'd)

Location and Service	Check Daily	After 1st 25 Hrs of Operation	Every 50 Hours of Operation	Every 100 Hours of Operation	Once Each Year
Hoses (all) - Inspect for cracks, swelling, weather checking or other signs of deterioration				X	X
Shift and Throttle Cable Linkage - Inspect and lubricate (A)				X[1]	X
Fuel Filters - Service or replace		O		O	O
Transmission and "V" Drive - Change fluid (B,C) and clean strainer, if equipped		O Hurth Only			O

MAINTENANCE SCHEDULE (cont'd)

Fresh-water cooled models - Clean sea-water section	As required [3] (X)
Fresh-water cooled models - Check coolant for boil/freeze protection	At least once each year (X)
Fresh-water cooled models - Change coolant	Every five years
Zinc Anodes - Heat exchanger and cooler - check condition	Every 30 days [3] (X)
Engine Assembly Exterior Surfaces - spray with rust-preventative oil (D)	Fresh water areas - Every 60 days (X) Salt water areas - Every 30 days (X)
Cooling System (SALT WATER AREAS ONLY) - Flush sea-water section	After use each day (X)

Notes:

(X) Denotes service to be performed by the owner/operator

(O) Denotes service to be performed by an authorized Crusader Marine Engines dealer

(A) Use SAE 30 engine oil

(B) All Velvet Drive and Hurth transmissions - Use Dexron III automatic transmission fluid

(C) All Velvet "V" Drive transmissions - Use Dexron III automatic transmission fluid

All Walters "V" Drive transmissions - Use Exxon Spartan EP-68 or SAE 30 engine oil

All Crusader "V" Drive transmissions - Use SAE 80W-90 gear oil

(D) Use WD-40 penetration oil or equivalent

[1] In fresh-water areas, every 100 hours of operation or 120 days (whichever occurs first). In salt-water areas, every 50 hours of operation or 60 days (whichever occurs first).

[2] In fresh-water areas, every 50 hours of operation or 60 days (whichever occurs first). In salt-water areas, every 25 hours of operation or 30 days (whichever occurs first).

[3] Requires more frequent inspection if used in extremely salty, polluted or mineral-laden waters.

VISUAL INSPECTION

It is important for the owner/operator to visually inspect the complete engine assembly at regular intervals. Most often, costly repairs can be avoided if potential problems are corrected before there is a failure.

Inspect the complete engine assembly for obvious fuel, oil, water or exhaust leaks. Check for loose, damaged or missing parts. Check all hose clamps for adequate tightness. Check the electrical system for loose or dirty connections or damaged wiring.

Touch up scratches, nicks and corrosion damage to the exterior finish of the engine. Spray paint may be obtained from your local Crusader Marine Engines Premier dealer.

Protect engine finish from corrosion by periodically spraying the engine exterior finish with a rust preventative oil (such as WD-40).

ENGINE FLUID CAPACITIES

Model	MP 5.0L / 5.7L	MP 6.0L	MP 8.1L
Crankcase Oil Capacity **W / NEW FILTER**			
Aluminum Pan	6 Quarts (5.67 L)[1]	5 Quarts (4.73 L)[1]	7 Quarts (6.65 L)[1]
Stamped Steel Pan	4.75 Quarts (4.5 L)[1]	N/A	N/A
Fresh Water Cooling System Capacity	23 Quarts (21.85 L)	23 Quarts (21.85 L)	33 Quarts (31.35 L)

TRANSMISSION FLUID CAPACITIES

Model	All Models	Type
Velvet Drive, 1:1 Ratio [1,2]	2.5 Quarts (2.37 L)	DEXRON III
Velvet Drive, 1:52 - 2.91:1 Ratio [1,2]	3.5 Quarts (3.31 L)	DEXRON III
Velvet Drive, V-Drive (exc. 5000), All Ratios [1,2]	4.5 Quarts (4.26 L)	DEXRON III
Velvet Drive 5000 (exc. V-Drive), All Ratios [1,2]	3.0 Quarts (2.37 L)	DEXRON III
Velvet Drive 5000 V-Drive, All Ratios [1,2]	4.5 - 5.0 Quarts (4.26 - 4.73 L)	DEXRON III
Hurth (Exc. V-Drive), All Ratios [1,2]	4.0 Quarts (3.79 L)	DEXRON III
Hurth V-Drive, All Ratios [1,2]	4.5 - 5.0 Quarts (4.26 - 4.73 L)	DEXRON III
Walters RV-36D V-Drive	1.5 Quarts (1.42 L)	SAE 30

1 - ***Capacities are dependent on installation angle.*** **ALWAYS** use the dipstick to determine the exact quantity of oil required. Add the correct amount of oil to fill to the "FULL" mark on the oil level dipstick. If you are unsure of the correct amount of oil to use during a service interval, perform the following procedure:

1. Drain the oil and change the oil filter.
2. Add four (4) quarts of new oil.
3. Start and run the engine allowing sufficient time for the new oil to circulate and fill the new oil filter.
4. Shut the engine off. Allow a sufficient amount of time for the oil to drain back to the pan. Check the oil level with the dipstick and add the correct amount of oil to fill to the "FULL" mark on the oil level dipstick.

Refer to the **Checking Fluid Levels** instructions page 41 and **Changing Oils** instructions page 60, of this manual, for complete instructions, important notes and Cautions for checking/changing engine oil.

2 - Check the transmission fluid level at operating temperature and immediately after shutdown of the engine.

FILTER REQUIREMENTS

Description	Part No.
Oil Filter (remote-mounted)	22679
Primary Fuel Filter Element	R080033
Fuel Control Cell (FCC) Fuel Filter Element	RP080026
Kit, Transmission Oil Filter (ZF)	RP077011

SYNC/CRUISE SPEED CONTROL SYSTEM

Description	Part No.
Sync/Cruise Speed Control Kit, Panel + 25ft Harness	RF152007
Sync/Cruise Speed Control Panel	RA152007
Speed Control Interface Harness - 25 Ft	RA121091
Speed Control Interface Harness - 45 Ft	RA121091A

ON-BOARD PARTS KITS

Description	Part No.
ON-BOARD PARTS KIT 5.7L (LH) **2007 TO PRESENT, FCC FUEL SYSTEM**	**RK173089D-07**
Box, On-Board (1)	22433
Belt, Serpentine (1)	R066028
Rotor, Distributor (HVS) (1)	R103011
Cap, Distributor (HVS) (1)	RA108009
Fuse, 5 Amp (2)	R153017C
Fuse, 15 Amp (2)	R153017A
Fuse, 20 Amp (2)	R153017B
Fuse, 20 Amp, MAXI (1)	R153019C
Fuse, 40 Amp, MAXI (1)	R153019F
Relay, 12V, Fuel Pump, Ignition (1)	R130015
Relay, 12V, Start (1)	R130016
Spark Plug, Set, (Platinum) (1)	RP030010
Impeller, Raw Water Pump (1)	RP061022
Primary Fuel Filter Element (1)	R080033
Filter and O-Ring, Kit, FCC (1)	RP080026

ON-BOARD PARTS KITS

Description	Part No.
ON-BOARD PARTS KIT 5.7L (RH) **2007 TO PRESENT, FCC FUEL SYSTEM**	**RK173089E-07**
Box, On-Board (1)	22433
Belt, Serpentine (1)	R066029A
Rotor, Distributor (HVS) (1)	R103011
Cap, Distributor (HVS) (1)	RA108009
Fuse, 5 Amp (2)	R153017C
Fuse, 15 Amp (2)	R153017A
Fuse, 20 Amp (2)	R153017B
Fuse, 20 Amp, MAXI (1)	R153019C
Fuse, 40 Amp, MAXI (1)	R153019F
Relay, 12V, Fuel Pump, **I**gnition (1)	R130015
Relay, 12V, Start (1)	R130016
Spark Plug, Set, (Platinum) (1)	RP030010
Impeller, Raw Water Pump (1)	RP061022
Primary Fuel Filter Element (1)	R080033
Filter and O-Ring, Kit, FCC (1)	RP080026
ON-BOARD PARTS KIT 8.1L **FCC FUEL SYSTEM - '07 To Present**	**RK173087-07**
Box, On-Board (1)	22433
Belt, Serpentine (1)	R066024A
Fuse, 5 Amp (2)	R153017C
Fuse, 15 Amp (2)	R153017A
Fuse, 20 Amp (2)	R153017B
Fuse, 20 Amp, MAXI (1)	R153019C
Fuse, 40 Amp, MAXI (1)	R153019F
Relay, 12V, Fuel Pump, **I**gnition (1)	R130015
Relay, 12V, Start (1)	R130016
Spark Plug, Set, (Platinum) (1)	RP030009
Impeller Kit, Raw Water Pump (1)	RP061022
Primary Fuel Filter Element (1)	R080033
Filter and O-Ring, Kit, FCC (1)	RP080026

ON-BOARD PARTS KITS

Description	Part No.
ON-BOARD PARTS KIT 6.0L **FCC FUEL SYSTEM - '08 To Present**	**TBD**
Box, On-Board (1)	22433
Belt, Serpentine (1)	R066033
Fuse, 5 Amp (2)	R153017C
Fuse, 15 Amp (2)	R153017A
Fuse, 20 Amp (2)	R153017B
Fuse, 20 Amp, MAXI (1)	R153019C
Fuse, 40 Amp, MAXI (1)	R153019F
Relay, 12V, Fuel Pump, Ignition (1)	R130015
Relay, 12V, Start (1)	R130016
Spark Plug, Set, (Platinum) (1)	RP030009
Impeller Kit, Raw Water Pump (1)	RP061022
Primary Fuel Filter Element (1)	R080033
Filter and O-Ring, Kit, FCC (1)	RP080026

CRUSADER MASTER ENGINE SPECIFICATIONS - 2009

MODEL (Horsepower)	MP 5.0L (275 HP)	MP 5.7L (330 HP)	MP 8.1L (STD) (385 HP)	MP 8.1L (HO) (425 HP)	MP 6.0L (375 HP)	Carb 5.7L (300 HP)
Displacement	5.0L (305 CID)	5.7L (350 CID)	8.1L (496 CID)	8.1L (496 CID)	6.0L (364 CID)	5.7L (350 CID)
Bore	3.75 in. (95.0 mm)	4.0 in. (101.6 mm)	4.25 in. (107.95 mm)	4.25 in. (107.95 mm)	4.0007 in. (101.618 mm)	4.0 in. (101.6 mm)
Stroke	3.48 in. (88.3 mm)	3.48 in. (88.3 mm)	4.370 in. (111.0 mm)	4.370 in. (111.0 mm)	3.622 in. (92.0 mm)	3.48 in. (88.3 mm)
Compression Ratio	9.4:1	9.4:1	9.1:1	9.1:1	9.67:1	9.4:1
Compression Pressure	130 - 215 psi	130 - 215 psi	130 - 175 psi	130 - 175 psi	130 - 215 psi	130 - 215 psi
WOT Operating RPM **Preferred WOT RPM**	4600-5000 (***5100*) **4800**	4800 - 5200 (***5300*) **5000**	4400 - 4800 (***4900*) **4600**	4800 - 5200 (***5300*) **5000**	5200 - 5600 (***5600*) **5500**	4800 - 5200 **5000**
Cruising RPM (Max)	3800	4000	3800	4000	4200	4000
Idle RPM (In Gear)	650 (Not Adjustable)	650 (Not Adjustable)	650 (Not Adjustable)	700 (Not Adjustable)	650 (Not Adjustable)	750
Oil Pressure @ 2000 RPM	25 - 60 psi (172 - 414 kPa)	25 - 60 psi (172 - 414 kPa)	25 - 60 psi (172 - 414 kPa)	25 - 60 psi (172 - 414 kPa)	25 - 80 psi (172 - 552 kPa)	25 - 60 psi (172 - 414 kPa)
Minimum Oil Pressure	6 psi (41.3 kPa) at Idle	6 psi (41.3 kPa) at Idle	6 psi (41.3 kPa) at Idle	6 psi (41.3 kPa) at Idle	6 psi (41.3 kPa) at Idle	10 psi (69 kPa) at Idle
Spark Plug P/N **Spark Plug Gap**	R030010 0.060 in.	R030010 0.060 in.	R030009 0.060 in.	R030009 0.060 in.	R030011 0.040 in.	R030010 0.045 in.
Firing Order	1-8-4-3-6-5-7-2 (LH) 1-2-7-5-6-3-4-8 (RH)	1-8-4-3-6-5-7-2 (LH) 1-2-7-5-6-3-4-8 (RH)	1-8-7-2-6-5-4-3 (LH) NA	1-8-7-2-6-5-4-3 (LH) NA	1-8-7-2-6-5-4-3 (LH) NA	1-8-4-3-6-5-7-2 (LH) 1-2-7-5-6-3-4-8 (RH)
Thermostat	FWC 170˚F (76.7˚C)	FWC 170˚F (76.7˚C)	FWC 170˚F (76.7˚C)	FWC 170˚F (76.7˚C)	FWC 170˚F (76.7˚C)	FWC 170˚F (76.7˚C)
Over-Temperature	210° F (98.9° C)	210° F (98.9° C)	210° F (98.9° C)	210° F (98.9° C)	210° F (98.9° C)	210° F (98.9° C)
Electrical System	12 Volt Negative (-) Ground	12 Volt Negative (-) Ground	12 Volt Negative (-) Ground	12 Volt Negative (-) Ground	12 Volt Negative (-) Ground	12 Volt Negative (-) Ground
Alternator Rating	70 / 100 Amps	70 / 100 Amps	70 / 100 Amps	70 / 100 Amps	70 / 100 Amps	70 / 100 Amps
Ignition Timing	Not Adjustable	Not Adjustable	Not Adjustable	Not Adjustable	Not Adjustable	26° @ 4000 RPM
CAM Retard	15 ± 2 degrees	15 ± 2 degrees	Not Adjustable	Not Adjustable	Not Adjustable	Not Adjustable
Battery Rating	650 CCA (Minimum) 120 Ah	650 CCA (Minimum) 120 Ah	650 CCA (Minimum) 120 Ah	650 CCA (Minimum) 120 Ah	650 CCA (Minimum) 120 Ah	650 CCA (Minimum) 120 Ah

CRUSADER MASTER FUEL PRESSURE SPECIFICATIONS - 2009

MODEL (Horsepower)	MP 5.0L (275 HP)	MP 5.7L (330 HP)	MP 8.1L (STD) (385 HP)	MP 8.1L (HO) (425 HP)	MP 6.0L (375 HP)	Carb 5.7L (300 HP)
Fuel Pressure FCC	57-62 psi @ WOT	57-62 psi @ WOT	57-62 psi @ WOT	57-62 psi @ WOT	59-62 psi @ WOT	
Fuel Pressure - FCC Returnless Fuel System w/mounted LPFP	57-62 psi @ WOT	57-62 psi @ WOT	66-69 psi @ WOT	66-69 psi @ WOT	66-69 psi @ WOT	
Fuel Pressure mounted LPFP	7 - 9 psi (WOT)	7 - 9 psi (WOT)	7 - 9 psi (WOT)	7 - 9 psi (WOT)	7 - 9 psi (WOT)	
Fuel Pressure remote LPFP						4 - 7 psi (WOT)

IMPORTANT: FUEL PRESSURE MEASUREMENT MUST BE MADE WITH THE ENGINE UNDER LOAD.

CRUSADER MASTER WARNING/ALARM SPECIFICATIONS - 2009

MODEL (Horsepower)	MP 5.0L (275 HP)	MP 5.7L (330 HP)	MP 8.1L (STD) (385 HP)	MP 8.1L (HO) (425 HP)	MP 6.0L (375 HP)	Carb 5.7L (300 HP)
Coolant Over-Temperature Sensor	210° F (98.9° C) M.I.L. - DTC 116/217 Check Engine Lamp and/or Buzzer	210° F (98.9° C) M.I.L. - DTC 116/217 Check Engine Lamp and/or Buzzer	210° F (98.9° C) M.I.L. - DTC 116/217 Check Engine Lamp and/or Buzzer	210° F (98.9° C) M.I.L. - DTC 116/217 Check Engine Lamp and/or Buzzer	210° F (98.9° C) M.I.L. - DTC 116/217 Check Engine Lamp and/or Buzzer	210° F (98.9° C) Check Gauges Lamp and/or Buzzer
Transmission Over-Temperature Switch	235° F ± 10° F M.I.L. - DTC 1542 Check Engine Lamp	235° F ± 10° F M.I.L. - DTC 1542 Check Engine Lamp	235° F ± 10° F M.I.L. - DTC 1542 Check Engine Lamp	235° F ± 10° F M.I.L. - DTC 1542 Check Engine Lamp	235° F ± 10° F M.I.L. - DTC 1542 Check Engine Lamp	235° F ± 10° F Check Gauges Lamp and/or Buzzer
Exhaust Over-Temperature Switch	248° F ± 5° F M.I.L. - DTC 2428 Check Engine Lamp and/or Buzzer	248° F ± 5° F M.I.L. - DTC 2428 Check Engine Lamp and/or Buzzer	248° F ± 5° F M.I.L. - DTC 2428 Check Engine Lamp and/or Buzzer	248° F ± 5° F M.I.L. - DTC 2428 Check Engine Lamp and/or Buzzer	248° F ± 5° F M.I.L. - DTC 2428 Check Engine Lamp and/or Buzzer	N/A
Low Oil Pressure Sensor or (Switch-5.7L carb only)	< 5 psi M.I.L. - DTC 524 Check Engine Lamp and/or Buzzer	< 5 psi M.I.L. - DTC 524 Check Engine Lamp and/or Buzzer	< 5 psi M.I.L. - DTC 524 Check Engine Lamp and/or Buzzer	< 5 psi M.I.L. - DTC 524 Check Engine Lamp and/or Buzzer	< 5 idle / 24 psi @4000 M.I.L. - DTC 524 Check Engine Lamp and/or Buzzer	< 10 psi Check Gauges Lamp and/or Buzzer

****IMPORTANT NOTICE:** ***Crusader engines incorporate an RPM "MAX GOVERNOR" in order to prevent the engine from over-revving. Engine operation above the Maximum RPM listed will appear normal, but will not exceed the (**MAX Governor) RPM listed. This is not recommended. If the engine is operating above the maximum RPM listed, a higher pitched propeller would be required to lower the engine maximum RPM to the Preferred RPM listed in the chart above.***

NOTE: FOR NEW BOAT PROPPING, IT IS RECOMMENDED THAT OEMS PROP TO THE MAXIMUM RPM LISTED.

Engine Specs
01/09

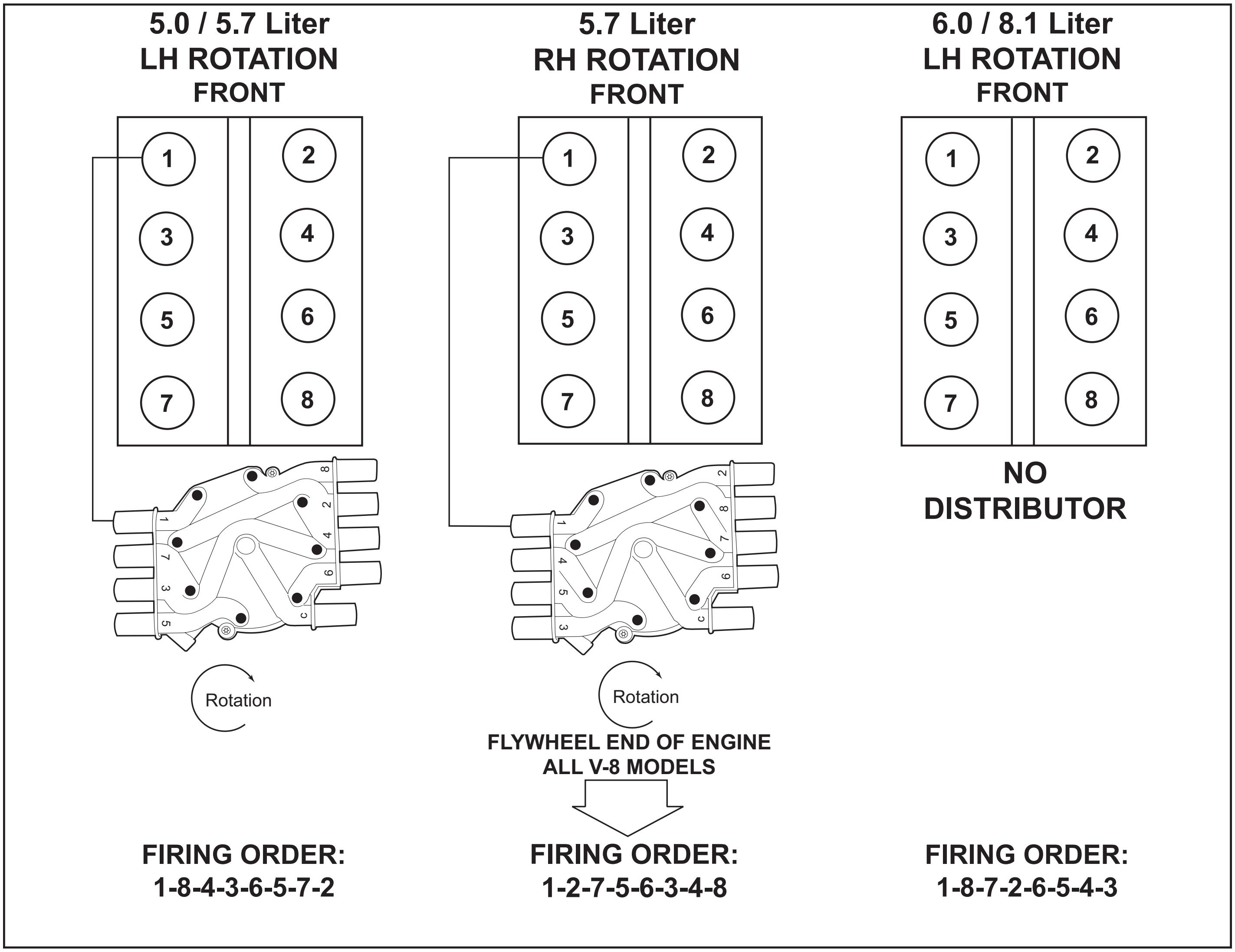


Figure 12-1 V-8 Firing Orders

TUNE-UP SPECIFICATIONS

Model	**MP 5.0L (275 HP)** **MP 5.7L (330 HP)**	**MP 6.0L (375 HP)**	**MP 8.1L(STD) (385 HP)** **MP 8.1L (HO) (425 HP)**
Spark Plug Type	R030010	R030011	R030009
Spark Plug Gap	0.060 in. (1.52 mm)	0.040 in. (1.02 mm)	0.060 in. (1.52 mm)
Ignition Timing	Fixed, Not Adjustable	Fixed, Not Adjustable	Fixed, Not Adjustable
Firing Order	1-8-4-3-6-5-7-2 (LH Rotation) 1-2-7-5-6-3-4-8 (RH Rotation)	1-8-7-2-6-5-4-3 (LH Rotation)	1-8-7-2-6-5-4-3 (LH Rotation)
CAM Retard	15 ± 2 degrees	Not Adjustable	Not Adjustable

ENGINE STORAGE

IMPORTANT: This service should be performed by an Authorized Crusader Premier Dealer.

> **CAUTION**
>
> **Refer to FLUSHING COOLING SYSTEM before proceeding.**

1. Fill the fuel tanks with gasoline and add a sufficient amount of gasoline stabilizer, such as STA-BIL™ fuel stabilizer, to prevent the formation of fuel gum and varnish. Follow the instructions on the container.

> **WARNING**
>
> **On fuel injected engines, you MUST bleed off fuel pressure before proceeding. Failure to do so may cause personal injury.**

2. Remove, empty and clean the fuel filter assembly. Reinstall with a new fuel filter and gasket/seals. Refer to Engine Maintenance for filter replacement procedures.

NOTE: DO NOT re-use old fuel filter components. Always replace with new fuel filter and gasket/seals.

> **WARNING**
>
> **Accumulation of water and other fuel contaminants may form corrosive compounds that can damage the fuel filter, and result in fuel leakage. Ethanol blended fuel may increase this risk. For this reason, annual replacement of the fuel filter, at a minimum, is required to avoid risk of explosion or fire.**

> **WARNING**
>
> Operate the bilge blower and be sure no fuel vapors are present when treating the engine. Be sure the engine compartment is well-ventilated to prevent a potential fire hazard.

3. Run the engine and allow it to reach normal operating temperature (a minimum of 10 minutes). Shut down the engine and change the oil and oil filter (See ENGINE MAINTENANCE).
4. Flush the cooling system if operating in salt water or brackish water areas. (See ENGINE MAINTENANCE).

> **WARNING**
>
> Operate the bilge blower and be sure no fuel vapors are present when treating the engine. Be sure the engine compartment is well-ventilated to prevent a potential fire hazard.

5. Restart the engine and allow it to idle for 5 minutes.
6. Turn off the ignition and remove the spark plugs. Use an aerosol-type fogging solution and spray a sufficient amount of oil into each cylinder. (Follow the instructions for the storage oil used.) Turn the crankshaft several revolutions by hand to spread the oil evenly throughout the cylinders.

> **CAUTION**
>
> Excess storage oil in the engine's cylinders can cause hydrostatic locking to occur, and severe damage to the engine.

7. Install the spark plugs and connect the spark plug wires.
8. Remove and clean the flame arrestor and the vent hoses, and reinstall on the engine. Cover the throttle body assembly ,to prevent the possibility of the water entering the engine through the throttle body assembly, during storage.
9. Close the fuel shut-off valve (if equipped).

DRAINING INSTRUCTIONS

CAUTION

If the boat is to remain in the water during or after draining, close the seacock to prevent a siphoning action that may occur, allowing sea water to flow from drain holes or removed hoses.

IMPORTANT: When removing the drain plugs, insert a wire into the hole to remove any obstruction which would prevent water from draining completely.

FRESH-WATER COOLED MODELS

IMPORTANT: The fresh-water section of the cooling system must be kept filled year around with recommended coolant. Make certain that the cooling system is protected with an ethylene glycol antifreeze mixture properly mixed to protect the engine to the lowest temperature that it will be exposed to.

See the ENGINE MAINTENANCE section for testing alkalinity, draining and refilling procedures of the Fresh Water Cooling System, as required.

IMPORTANT: Drain the sea-water section of the cooling system only.

1. Remove all the drain plugs from the following locations:
   - Heat Exchanger - one on outboard side
   - Exhaust Elbows (**5.0/5.7/8.1L ONLY**) - two on each side
   - Transmission and Engine Cooler - one drain plug
   - Fuel Control Cell (Returnless Fuel System Only) - Remove inlet and outlet water hoses.
2. Remove the hose from the inlet side of the sea-water pump.
3. Remove the hose from the outlet side of the sea-water pump.

NOTICE: It may be necessary to bend or lift the hoses to allow water to drain completely.

4. Remove the raw water pump impeller. (See ENGINE MAINTENANCE) If inspection proves the impeller to be in good condition, store it in an accessible spot for re-installation at the end of the storage period. A damaged or badly worn impeller should be discarded and a new one installed at the end of the storage period.

NOTE: Removal of the impeller during storage will prevent the impeller vanes from drying and taking a permanent “set”.

5. After the water has completely drained, coat the threads of drain plugs with PerfectSeal (or equivalent), and reinstall in the proper locations. Reinstall the hoses and tighten all the clamps securely.
6. Loosen the engine alternator and raw water pump drive belt.

After draining is completed, perform the additional required maintenance as outlined in the MAINTENANCE SCHEDULE under ONCE EACH YEAR.

BATTERY STORAGE

Follow the battery manufacturer’s instructions for storage. If not available, use the following instructions:

- Remove the battery from the boat and clean, removing dirt and grease from the top of the battery.
- Fill the battery with distilled water to the manufacturer’s specifications.
- Store the battery in a cool, dry place. Do not store on a concrete surface.
- Periodically (every 30 to 45 days), check the water level and recharge the battery to the manufacturer’s specifications. Do not fast charge.

CAUTION

A discharged battery can be damaged by freezing.

OUT-OF-SEASON ENGINE WARM-UP

If it is necessary to start your engine(s) during cold weather storage, refer to the following procedure.

1. Refer to “Recommissioning After Storage” to make certain all drain plugs, hoses, batteries and connections are secure.
2. Start the engine(s) and idle until normal engine oil pressure is reached.
3. Raise the engine RPM and hold at 1500 RPM until NORMAL operating temperature is reached.
4. Raise the engine RPM again and hold at 2500 RPM. Allow the engine to run for approximately 5 minutes in order to heat up the exhaust system.
5. Return the engine to idle speed and shut the engine “OFF.”
6. Refer to “Engine Storage” and “Draining Instruction” to make certain the engine is fully protected from freezing during the remaining storage period.

Following this procedure will reduce the possibility of condensation build up in the engine exhaust system, due to cold weather start-ups.

RECOMMISSIONING AFTER STORAGE

IMPORTANT: This service should be performed by an Authorized Crusader Marine Engines Premier Dealer.

When recommissioning the engine after storage, the following items should be checked:

1. Assemble the raw water pump and reinstall on the engine.
2. Check all the cooling system hoses. Be sure they are properly connected and all the hose clamps are tight.

CAUTION

When installing the battery, make certain that you connect the POSITIVE (+) BATTERY CABLE to the POSITIVE (+) BATTERY TERMINAL first, and the NEGATIVE (-) BATTERY CABLE to the NEGATIVE (-) BATTERY TERMINAL last. If the battery cables are reversed, the electrical system will be damaged.

WARNING

Do not use jumper cables and/or a booster battery to start the engine. Do not recharge a weak battery in the boat. Remove the battery and recharge in a ventilated area away from fuel vapors, sparks or open flame.

3. Install the fully charged battery. Be sure that all the connections are clean and free from corrosion. Coat the battery terminal connections with an anti-corrosion battery terminal spray.
4. Readjust alternator and water pump drive belt tension.
5. Check engine alignment.
6. Check engine and transmission oil levels.
7. Check engine mount fasteners.

RECOMMISSIONING AFTER STORAGE

8. Open the fuel shut-off valve (if equipped).

9. Refer to the OPERATING INSTRUCTIONS section and perform all the safety checks before starting the engine.

10. Refer to the Engine Maintenance section and perform the Priming the Fuel System instructions.

CAUTION

If the engine(s) is (are) to be started prior to launching, use the procedure FLUSHING COOLING SYSTEM before proceeding to start the engine(s).

11. Open the seacock before starting the engine.

12. Start the engine and closely observe the instrument panel. Allow the engine to reach normal operating temperature. Inspect the engine carefully for fuel, exhaust, oil and water leaks.

13. Check the steering, shift and throttle controls for proper operation.

Engine performance complaints usually fall under one of the basic headings listed in the Troubleshooting Guide. When a problem cannot be easily diagnosed, consult a Crusader Marine Engines Premier Dealer for assistance.

Malfunction	Possible Cause	Corrective Action
“Check Engine” light on with the engine running	Problem with the engine management system.	Contact Crusader Marine Engines Premier Dealer.
Engine will not crank with the starter motor, or cranks slowly.	Battery switch turned OFF (if equipped)	Turn the battery switch ON.
NOTICE: Battery voltage must be AT or ABOVE 10 volts while the engine is cranking or the engine management system will not function.	Remote control not in Neutral position.	Position the remote control exactly in Neutral.
	Blown the ignition fuse or open circuit breakers.	Replace the fuse - reset circuit breakers.
	Loose and/or dirty wiring connections.	Check the battery cables and starter circuit wiring. Clean and tighten all connections. Repair or replace the damaged wiring.
	Dead Battery	Recharge, test and replace as necessary.
Engine Cranks - will not start or is hard starting.	Improper starting procedure.	Refer to “STARTING ENGINE” in the OPERATING INSTRUCTIONS section.
NOTICE: Battery voltage must be AT or ABOVE 10 volts while the engine is cranking or the engine management system will not function.	No fuel - empty fuel tank	Check the fuel tank level - fill tank(s). Open shut-off valve(s).
	No fuel at the injectors (MPI)	Plugged fuel filters. Plugged or kinked fuel lines or plugged fuel-tank vent. Faulty fuel pump - check electrical connections. Faulty anti-siphon valve.
	Engine flooded	Open the throttle 100% and crank the engine. When the engine starts, immediately return the throttle to 1000 RPM.
	Ignition system malfunction	Contact Crusader Marine Engines Premier Dealer.
	Contaminated fuel	Check fuel for water or other contamination. If contaminated, drain and clean the fuel system.

Malfunction	Possible Cause	Corrective Action
Engine Overheats	Loose or worn drive belt	Adjust or replace the belt as necessary.
	Collapsed, kinked or leaking hoses.	Replace the hoses.
	Transmission/engine oil cooler plugged	Remove the water hoses and flush in opposite direction of the normal flow.
	Faulty thermostat	Replace the thermostat.
	Sea-water intake valve partially/fully closed.	Open the valve completely.
	Restricted sea-water pickup or sea strainer	Remove restriction.
	Faulty temperature sending unit or gauge	Test and replace as necessary.
	Sea-water pump impeller worn or damaged	Replace the impeller.
	Coolant level low in the fresh-water section of the cooling system	Check the cooling system for leaks. Refill the system. See Warning before removing the fill cap.
	Heat exchanger passages plugged with scales and debris	Clean and flush the exchanger.
	Improper coolant mixture	Install the proper coolant mixture (50% antifreeze - 50% water).
Insufficient engine temperature	Faulty thermostat	Replace the thermostat.
	Faulty temperature sender	Replace the temperature sender.
Engine oil pressure low	Faulty oil pressure sending unit or gauge	Test and replace as necessary.
	Oil level low	Add specified oil. Check the engine for leaks.
	Crankcase overfilled causing oil aeration	Remove the required amount of oil. Determine the cause of overfilled condition (improper filling, etc.).
	Diluted or improper grade/ viscosity of oil	Change the oil and filter. Determine the cause of dilution. (insufficient engine temperature, excessive idling, etc.)

Malfunction	Possible Cause	Corrective Action
Transmission slipping - erratic operation	Low oil level	Add specified oil. Check the transmission for leaks.
	Transmission overfilled causing oil aeration	Drain required amount of oil.
	Transmission shift lever not fully engaged	Adjust the shift linkage and remote control. Check the shift cables for freedom of movement and binding.
	Contaminated fluid	Determine and correct the contamination source and change the fluid.
Engine misses, runs rough and/or backfires	Ignition system malfunction	Contact Crusader Marine Engines Premier Dealer.
	Plugged fuel filters	Replace the fuel filters.
	Faulty fuel pump.	Have fuel pump replaced by a Crusader Marine Engines Dealer
	Plugged or kinked fuel lines or fuel tank vent	Repair or replace the fuel lines. Remove obstruction.
	Anti-siphon valve faulty	Clean or replace as necessary.
	Flame arrestor dirty	Clean the flame arrestor.
Poor engine or boat performance	Ignition malfunction	Contact Crusader Marine Engines Premier Dealer.
	Throttle not fully open	Check the remote control and throttle body linkage for freedom of movement and proper adjustment.
	Damaged or improper propeller	Repair or replace as necessary.
	Excessive water in the bilge	Pump the water out and investigate source of entry.
	Excessive growth on the boat bottom	Clean the bottom and paint with an anti-fouling paint.
	Boat overloaded	Reduce and/or redistribute the load.
	Dirty flame arrestor	Clean the flame arrestor.
	Engine overheating	Repair the cooling system (See “Engine Overheats”).

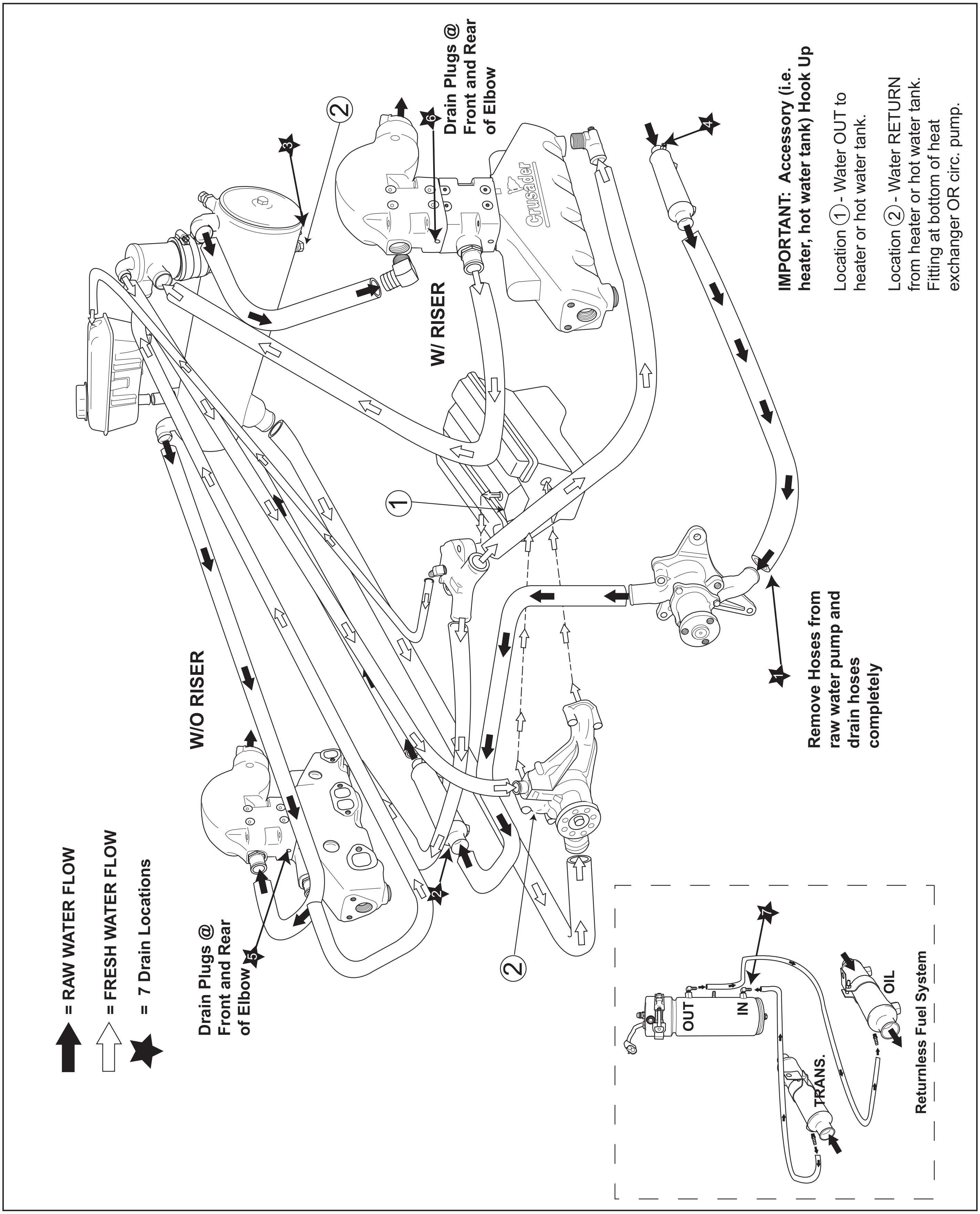
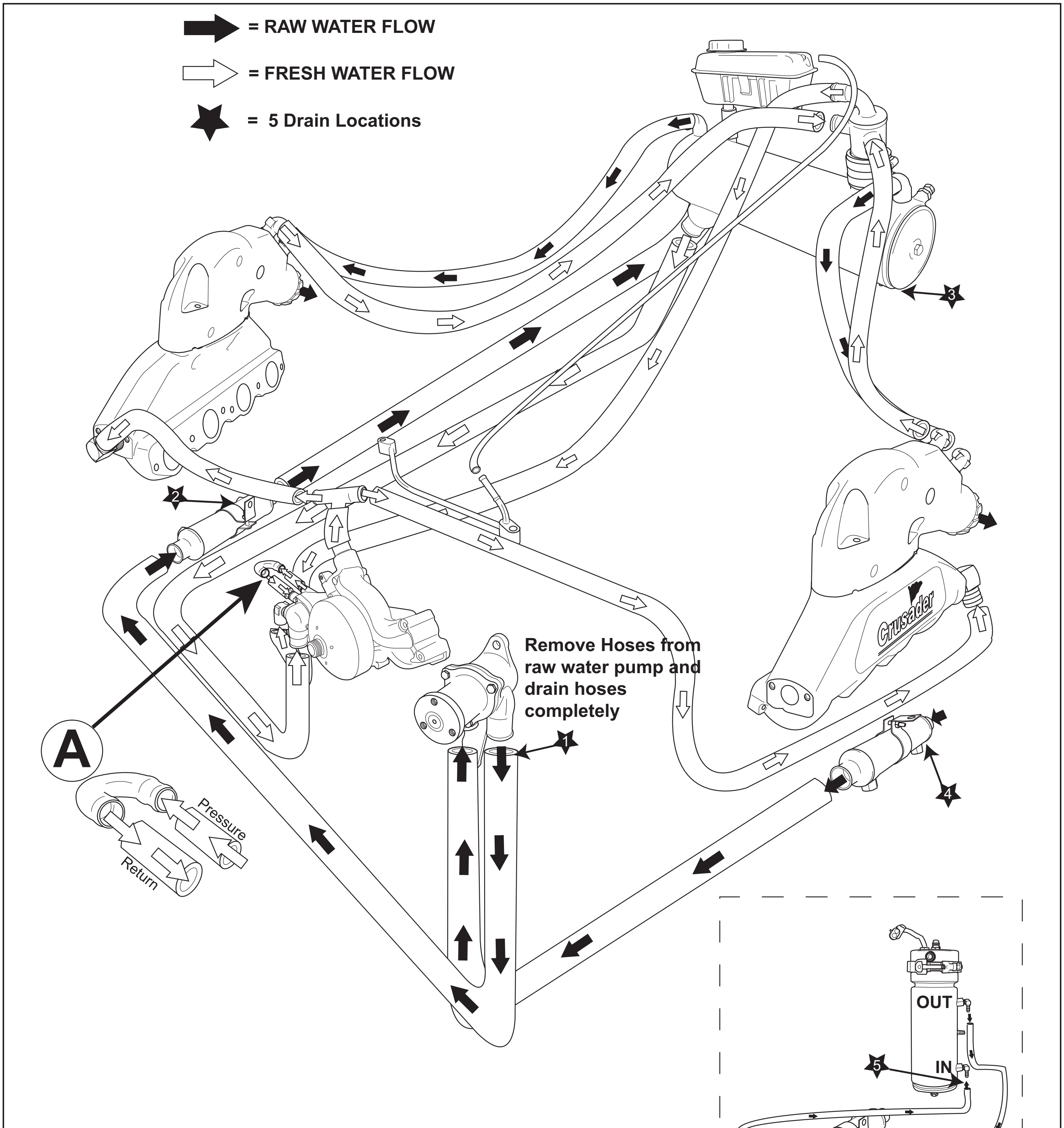


Figure 15-1 Fresh-Water Cooling System 5.0/5.7L (Typical)



IMPORTANT: Accessory (i.e. heater, hot water tank) Hook Up

NOTE: Location (A) is the location in order to hook up a hot water accessory.

Figure 15-2 Fresh-Water Cooling System 6.0L (Typical)

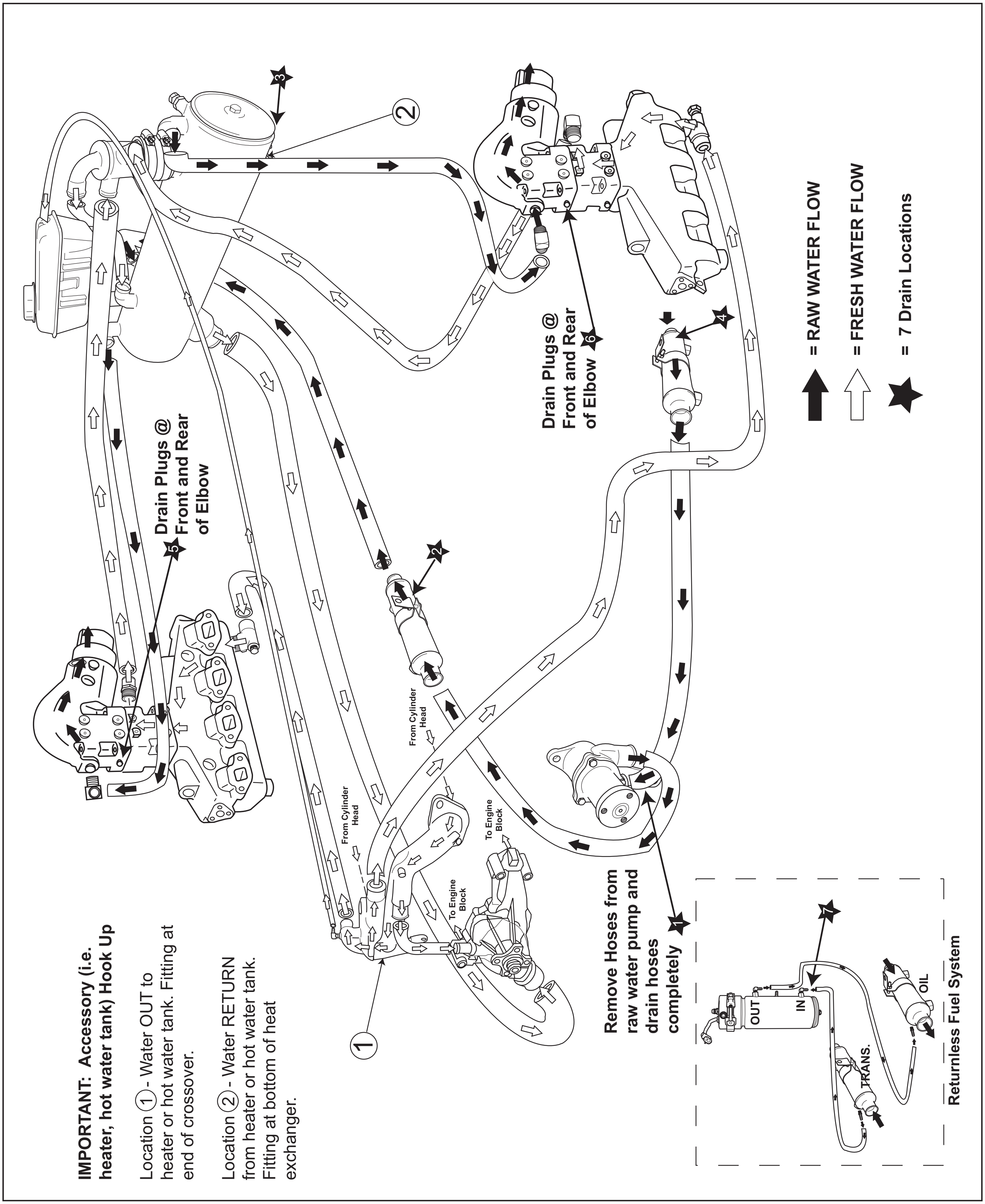


Figure 15-3 Fresh-Water Cooling System 8.1L (Typical)

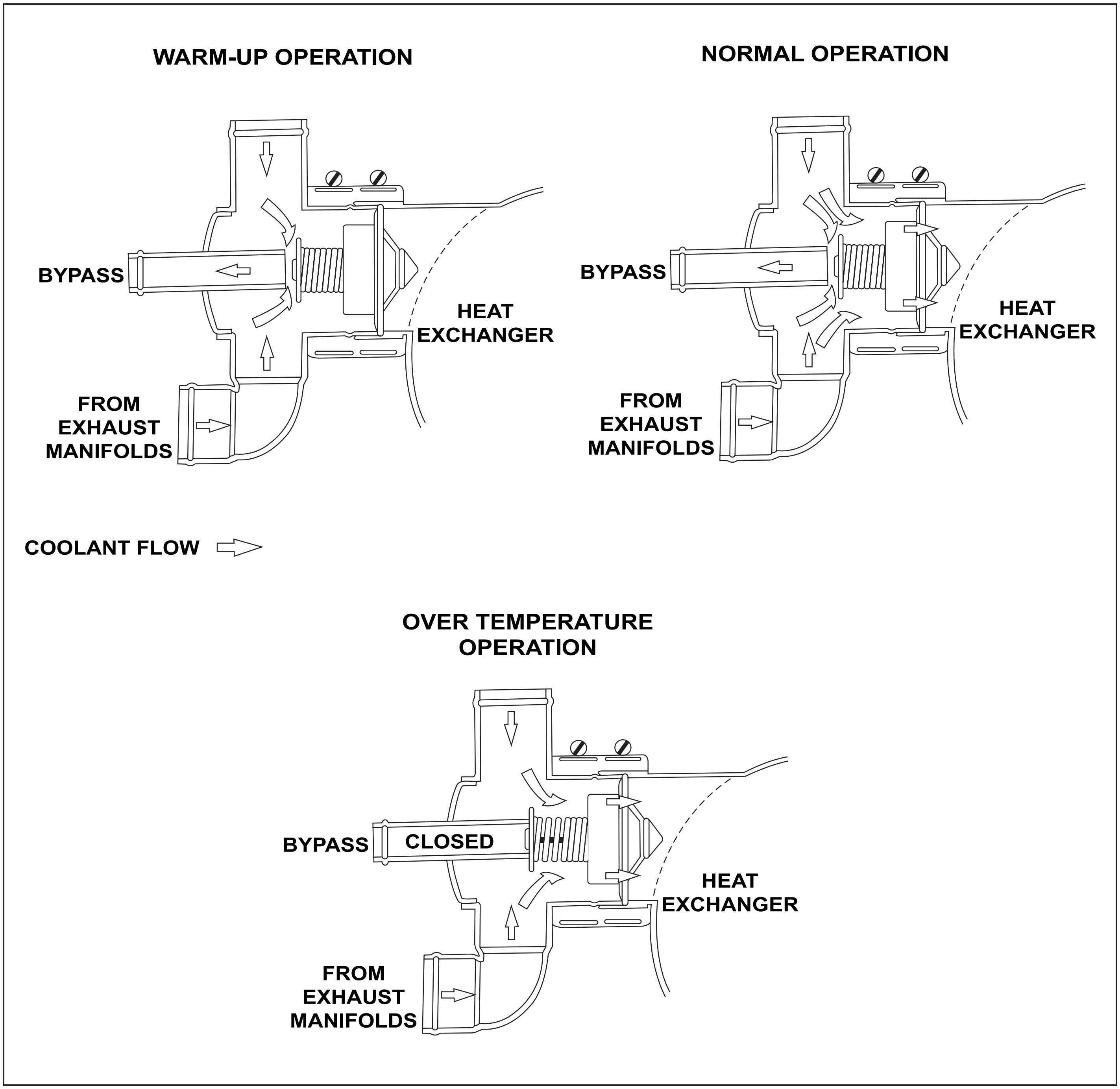


Figure 15-4 Thermostat Housing Waterflow Diagrams and Fill-Riser Waterflow - 8.1L Fresh-Water Cooled

NOTE: ENGINE HARNESS WIRED FOR PANELS USING VOLTMETERS ONLY.

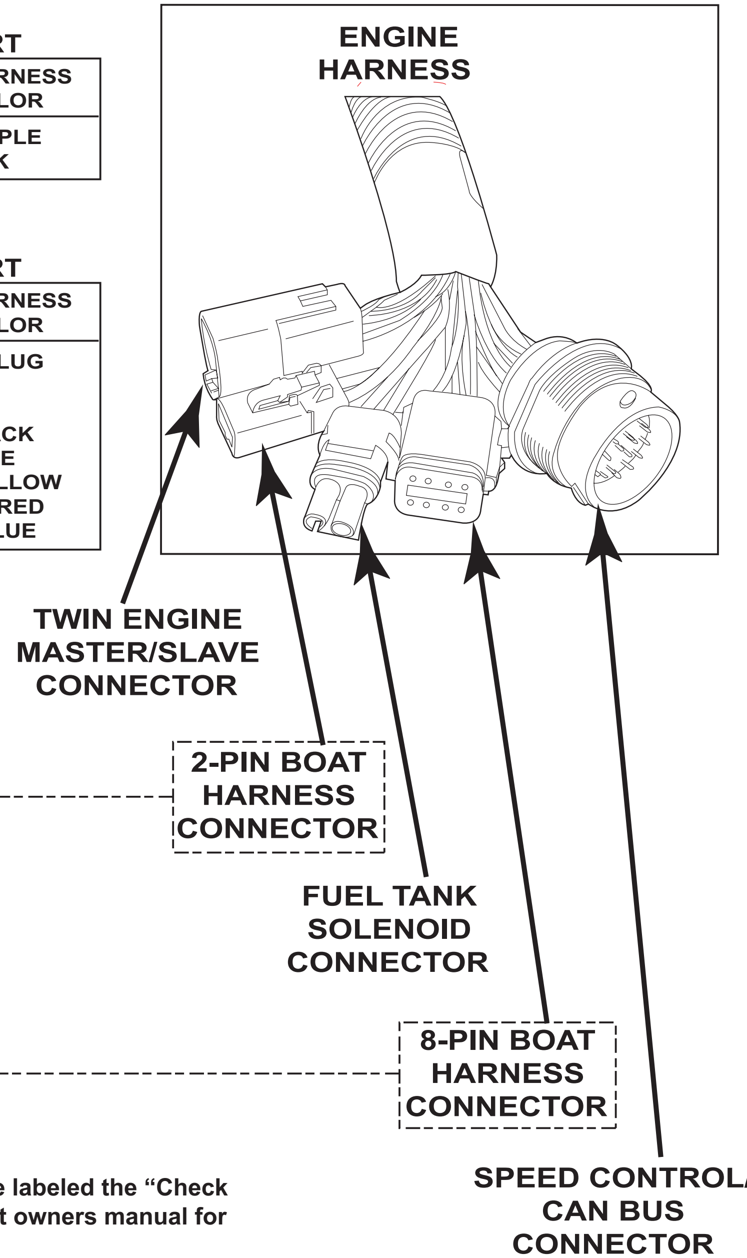
NOTE (A): POWER FOR A FUSED ACCESSORY PANEL MAY BE TAKEN FROM THIS LOCATION. LOAD CANNOT EXCEED 30 AMPS.

2-PIN WIRE HARNESS COLOR CHART

CIRCUIT NUMBER	CIRCUIT NAME	ENGINE HARNESS WIRE COLOR
(A) 1.	VBAT	RED/PURPLE
2.	GROUND	BLACK

8-PIN WIRE HARNESS COLOR CHART

CIRCUIT NUMBER	CIRCUIT NAME	ENGINE HARNESS WIRE COLOR
1.	(OPEN)	CAVITY PLUG
2.	TACHOMETER	GRAY
3.	COOLANT TEMP	TAN
4.	BUZZER	TAN/BLACK
5.	IGNITION	PURPLE
6.	MIL	GREEN/YELLOW
7.	STARTER	YELLOW/RED
8.	OIL PRESSURE	DARK BLUE



NOTE: The 'MIL' or Malfunction Indicator Lamp may be labeled the "Check Engine Lamp" on the instrument panel. Check the boat owners manual for exact labelling.

Figure 16-1 Typical Instrumentation Wiring

IMPORTANT: Your engine is designed to work with the standard electronics installed in your boat. If you add other electrical components or accessories, you could change the way the fuel injection controls your engine or the overall electrical system functions. Before adding electrical equipment, consult your dealer. If you don't, your engine may not perform properly.

⚠ CAUTION
Add-on equipment may adversely affect the alternator output or overload the electrical system. Any damage caused as a result will not be covered by, and may void, your warranty.

To obtain service and/or parts literature for your Crusader Marine Engine, contact the following:

Crusader Marine Engines
Pleasurecraft Engine Group
Publications Department
1737 Highway 76 East
Little Mountain, SC 29075

IMPORTANT: When contacting the factory for service information, be sure to include your engine model and serial number to insure the service information you receive is correct.

SUMMARY OF WARRANTY TERM LIMITS

This list does not, in any way, modify the official Limited Warranty Statement of Crusader Engines. This list has been compiled only as a general outline of year and hour limits imposed on different models of Crusader engines. Please review the official Limited Warranty Statements for specific terms and limitations as they apply to the particular engine / component involved.

ENGINE MODEL YEAR:	WARRANTY COVERAGE TERM:
2006	2 year, unlimited hours, GM engine. 2 year, unlimited hours, Transmission.
2007	2 year, unlimited hours, GM engine. 2 year, unlimited hours, Transmission.
2008	2 year, unlimited hours, GM engine. 2 year, unlimited hours, Transmission.
2009	2 year, unlimited hours, GM engine. 2 year, unlimited hours, Transmission.
Base Engine	1 year, 200 hours with exclusions.

Note:

CRUSADER OWNERSHIP CHANGE NOTICE

If you are the new owner of a Crusader Marine Engine on which the warranty has expired and would like to inform Crusader of your ownership for notification purposes in case of Service Updates, Recalls, etc., complete the section below and return by mail to Crusader Marine Engines, PO Drawer 369, Little Mountain, SC 29075.

	PORT	STARBOARD
ENGINE MODEL:		
ENGINE SERIAL NUMBER:		
TRANS. MODEL:		
TRANS. SERIAL NUMBER:		
HULL SERIAL #:		

(New Owner) NAME: ____________________

ADDRESS: ____________________

CITY,STATE,ZIP: ____________________

DATE OF PURCHASE: ____________________

(Previous Owner)NAME: ____________________

ADDRESS: ____________________

CITY,STATE,ZIP: ____________________

CRUSADER WARRANTY TRANSFER APPLICATION
(PORT OR SINGLE ENGINE)

The remainder of the original Crusader limited warranty is transferable **within thirty (30) days of date of sale** by the original owner/user to a subsequent purchaser for the remainder of the unused portion of the original warranty term, **provided the engine(s) operating hours do not exceed 300.** The original date of sale or original in-service date (whichever comes first) begins the warranty coverage period.

Direct Sale by Owner/Dealer or First Operator:

- The second purchaser can be registered as the owner and retain the unused portion of the warranty term by sending the following:
  - Original owner's Warranty Registration Card
  - Copy of Bill of Sale/Sales Contract/Operator Contract
  - Completed Warranty Transfer Application
  - Warranty transfer fee

Transfer Fee:

- **The fee for transfer is $50.00 per engine.** The applicable transfer fee must be submitted via certified check **within 30 days of date of sale** along with the transfer application information to:

  Crusader Marine Engines
  Marine Warranty Transfer
  P.O. Drawer 369
  Little Mountain, S.C., 29075, USA

- A new "Owner Warranty Registration Card" will be issued with the new owner's name and address. Registration records will be changed in the factory registration file.

OUTSIDE THE U.S. AND CANADA, CONTACT YOUR LOCAL CRUSADER DEALER OR WARRANTY SERVICES AT (803)345-0050 FOR MORE INFORMATION ON HOW TO APPLY TO THIS PROGRAM.

IMPORTANT! PURCHASER NOTICE: The checks listed below are designed to insure safety and satisfaction. Premier Crusader Dealer Technicians have received step-by-step instruction in the performance of the Pre-Delivery Inspection. Therefore, we require the following inspection be performed at your expense by a qualified technician prior to delivery. By signature the technician certifies that he/she has checked the installation and operation of the engine and finds it to be performing properly. All terms in the Limited Warranty located in the Engine Owners Manual still apply.

ENGINE MODEL:________________________________ **ENGINE SERIAL:**________________________________

TRANS. SERIAL:________________________________ **ENGINE HOURS:**________________________________

HULL SERIAL #:________________________________

Pre-Delivery Checklist - PORT or Single

☐ Check for Bulletins	☐ Belt and Pulley: Inspect for Damage
☐ Engine Oil: Check	☐ All Drain Plugs: Confirm Proper Installation
☐ Drive Lube: Check	☐ All Fuel Lines: Confirm No Leaks
☐ Battery Rating, Charge, and Level: Check	☐ All Oil Lines: Confirm No Leaks
☐ Control Adjustments: Confirm Proper Operation	☐ All Water Lines: Confirm No Leaks
☐ Gauges: Check for Proper Operation	☐ Electrical Wiring: Check for Proper Installation
☐ Record Propeller Size, Rotation and WOT WOT RPM_______Diameter________ Pitch________Rotation_________	
☐ Record Fuel Pressure, WOT ______	☐ Trouble Codes Checked Trouble Codes Cleared
☐ Dealer Reviewed Warranty with Owner	

DATE OF SALE (2ND Owner) __________/________/________ **DATE OF SALE (1st Owner/1st Operator)** __________/______/______

(New Owner)
NAME:____

ADDRESS:____

CITY,STATE, ZIP_______________________________________

(Previous Owner)
NAME:____

ADDRESS:____

CITY,STATE, ZIP_______________________________________

I hereby certify the Pre-Delivery Checklist on engine #___________ and have corrected any abnormality revealed by this inspection.

______________________________ ______________________________ ______________________________

(Technician Signature, Dealer & Date) **(Seller's Signature & Date)** **(Purchaser's Signature & Date)**

CRUSADER WARRANTY TRANSFER APPLICATION (STARBOARD ENGINE)

The remainder of the original Crusader limited warranty is transferable **within thirty (30) days of date of sale** by the original owner/user to a subsequent purchaser for the remainder of the unused portion of the original warranty term, **provided the engine(s) operating hours do not exceed 300.** The original date of sale or original in-service date (whichever comes first) begins the warranty coverage period.

Direct Sale by Owner/Dealer or First Operator:

- The second purchaser can be registered as the owner and retain the unused portion of the warranty term by sending the following:
  - Original owner's Warranty Registration Card
  - Copy of Bill of Sale/Sales Contract/Operator Contract
  - Completed Warranty Transfer Application
  - Warranty transfer fee

Transfer Fee:

- **The fee for transfer is $50.00 per engine.** The applicable transfer fee must be submitted via certified check **within 30 days of date of sale** along with the transfer application information to:

  Crusader Marine Engines
  Marine Warranty Transfer
  P.O. Drawer 369
  Little Mountain, S.C., 29075, USA

- A new "Owner Warranty Registration Card" will be issued with the new owner's name and address. Registration records will be changed in the factory registration file.

OUTSIDE THE U.S. AND CANADA, CONTACT YOUR LOCAL CRUSADER DEALER OR WARRANTY SERVICES AT (803)345-0050 FOR MORE INFORMATION ON HOW TO APPLY TO THIS PROGRAM.

IMPORTANT! PURCHASER NOTICE: The checks listed below are designed to insure safety and satisfaction. Premier Crusader Dealer Technicians have received step-by-step instruction in the performance of the Pre-Delivery Inspection. Therefore, we require the following inspection be performed at your expense by a qualified technician prior to delivery. By signature the technician certifies that he/she has checked the installation and operation of the engine and finds it to be performing properly. All terms in the Limited Warranty located in the Engine Owners Manual still apply.

ENGINE MODEL:________________________________ **ENGINE SERIAL:**________________________________

TRANS. SERIAL:________________________________ **ENGINE HOURS:**________________________________

HULL SERIAL #:________________________________

Pre-Delivery Checklist - STARBOARD

- ☐ Check for Bulletins
- ☐ Belt and Pulley: Inspect for Damage
- ☐ Engine Oil: Check
- ☐ All Drain Plugs: Confirm Proper Installation
- ☐ Drive Lube: Check
- ☐ All Fuel Lines: Confirm No Leaks
- ☐ Battery Rating, Charge, and Level: Check
- ☐ All Oil Lines: Confirm No Leaks
- ☐ Control Adjustments: Confirm Proper Operation
- ☐ All Water Lines: Confirm No Leaks
- ☐ Gauges: Check for Proper Operation
- ☐ Electrical Wiring: Check for Proper Installation
- ☐ Record Propeller Size, Rotation and WOT
  WOT RPM_______Diameter________ Pitch________Rotation_________
- ☐ Record Fuel Pressure, WOT ______
- ☐ Trouble Codes Checked
  Trouble Codes Cleared
- ☐ Dealer Reviewed Warranty with Owner

DATE OF SALE (2ND Owner) _________/_______/_______ **DATE OF SALE (1st Owner/1st Operator)** _________/______/______

(New Owner)
NAME:____

ADDRESS:____

CITY,STATE, ZIP____

(Previous Owner)
NAME:____

ADDRESS:____

CITY,STATE, ZIP____

I hereby certify the Pre-Delivery Checklist on engine #___________ and have corrected any abnormality revealed by this inspection.

________________________________ **(Technician Signature, Dealer & Date)**

________________________________ **(Seller's Signature & Date)**

________________________________ **(Purchaser's Signature & Date)**

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CRUSADER, INC. INBOARD MARINE ENGINES
TWO (2) YEAR LIMITED WARRANTY
(For Engines Sold and Used in the United States and Canada Only)

1. Crusader, Inc. (hereinafter referred to as "Crusader") warrants each of its new inboard marine engines and accessories attached thereto ("Products"), to be free from defects in material and workmanship for a period of two (2) years, except to the extent limited herein. This Limited Warranty commences on the day of the first retail sale and/or the first date used, and extends to the original and subsequent retail sales; however, in no event shall the duration of the Limited Warranty exceed two (2) years, as measured from the original retail sale date.

2. Under this Limited Warranty, Crusader's obligation is limited to repairing or replacing those parts of Products that have become defective within the applicable warranty period, because of defective materials or workmanship. Crusader will arrange for the correction of all defects under this Limited Warranty to be made free of charge at the selling dealership or an authorized Crusader service center. Crusader, in its discretion, may provide for the repair or replacement of any defective part at Crusader's facility. Crusader will make payment for labor to replace such parts as provided in the, then, current flat rate labor manual or Warranty Procedures Manual.

3. This Limited Warranty does not apply to Product defects caused by normal wear and tear to Products, and/or damage to Products arising out of negligence or lack of proper care, improper installation or service, operation with fuels, oils or lubricants which are not suitable for use with Products, alterations or removal of parts, water entering an engine through the exhaust system or carburetor, installation of accessories or parts not manufactured or sold by Crusader, or Products rendered defective by accident.

4. If a part should become defective within the applicable warranty period, advance authorization by Crusader is necessary before the part is replaced or a defect is corrected by a service representative; otherwise Crusader will not be liable for the expense of the replacement or correction.

5. Replacement parts and accessories supplied by Crusader, and installed on a Product during the period when the Product is covered under the provisions of this Limited Warranty, are warranted for the unexpired portion of the existing warranty period, or ninety (90) days from the date of installation of such new parts or accessories, whichever is longer.

6. Reasonable access to the Product must be provided for warranty service. This Limited Warranty does not cover: (1) telephone or telegram charges, towing charges, storage, launch and haul out charges, loss or damage to personal property, loss of revenue, loss of time, travel, lodging, inconveniences or other CONSEQUENTIAL DAMAGES, or (2) removal and/or replacement of boat partitions or material, because of boat design, for necessary access to the Product.

7. NO OTHER WARRANTY GIVEN. THE OBLIGATIONS SET FORTH IN THE PRECEDING PARAGRAPHS ARE CRUSADER'S SOLE OBLIGATIONS AND OWNER/USER'S EXCLUSIVE REMEDY. CRUSADER MAKES NO OTHER WARRANTY, EXPRESS OR IMPLIED (except to the extent provided in the immediately following paragraph), AND MAKES NO WARRANTY OF MERCHANTABILITY OR FITNESS FOR PARTICULAR PURPOSE.

However, to the extent that any warranty may be implied by law, the term of such implied warranty shall be limited to a period of time corresponding to the period of express warranty applicable to the particular Product, and its use by the owner/user, as set forth herein, commencing on the date of the first retail sale of the Product to the first registered owner or registered user. Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you. This is sole warranty provided respecting Crusader's Products, and no other party may make a warranty to owner/user.

CRUSADER SHALL NOT BE LIABLE FOR ANY LOSS OF TIME, INCONVENIENCE, COMMERCIAL LOSS OR DIRECT OR INDIRECT, INCIDENTAL (except as specifically provided herein) OR CONSEQUENTIAL DAMAGES. Some state do not allow the exclusion or limitation of incidental or consequential damages, so this limitation or exclusion may not apply to you. This Warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Any owner/user hereby waives for himself/herself/itself and his/her/its successors and assigns (a) any and all claims for punitive damages, and (b) all claims of negligence or strict liability or both. In no event will Crusader's liability exceed the purchase price of the Products which is actually paid to Crusader.

8. To make a claim under this Limited Warranty, contact the selling dealer from which your Crusader powered boat was originally purchased or the nearest authorized Crusader servicing dealer. It is recommended that your warranty service be performed by the dealer which sold the Product to you because of that dealer's personal interest in you as a customer. Your Crusader powered Product must be delivered to the servicing dealer within the applicable warranty period. Proof of purchase may be required by the Crusader dealer to substantiate any warranty claim. Use your Crusader Owner Warranty Registration Card to establish proof of purchase.

9. ITEMS NOT COVERED UNDER LIMITED WARRANTY

This Limited Warranty is limited to defects in material and workmanship. To avoid misunderstandings regarding warranty coverage, the following describes some, but not all, of the more common types of service that are not covered by this Limited Warranty.

- Normal service requirements arising during the warranty period, such as fuel system or ignition adjustments, tune-ups, filter, adjusting controls or lubrications.
- Damage caused by neglect, lack of maintenance, abnormal operation accident or improper installation or service.
- Normal wear of the piston rings, cylinders, water pump and other engine parts.
- Haul out, launching, towing charges, dockage or storage fees, removal and/or replacement of boat partitions or material, because of boat design, for necessary access to the product.
- All related transportation charges and/or travel time.
- The cost of shipping replacement parts by air freight or other premium freight methods
- Improper winterizing resulting in freezing and breaking of the engine block, cylinder heads, exhaust manifolds, heat exchanger or other damage.
- Repairs made necessary by normal wear, rust, electrolysis or corrosion, or by the use of the parts or accessories which are either incompatible with the Crusader product or adversely affect its operation, performance or durability.
- Valve or valve seat grinding required because of wear.
- Failure or damage due to lack of cooling water caused by starting the Product out of the water or by foreign material blocking the water inlets.
- Cleaning of the engine fuel system due to water or dirt contamination of the boat fuel system.
- Use of fuel and lubricants which are not suitable for use with or on the Product. Refer to the Operation and Maintenance Manual.
- Damage to the engine and/or transmission caused by striking a submerged object. (This is considered a marine hazard).

10. This Limited Warranty shall be governed by, and construed and interpreted in accordance with, the laws of the State of Ohio, without application of its conflicts of laws principles, except only to the extent replaced or precluded by other law of mandatory application.

11. SPECIAL STATE LEGAL REQUIREMENTS. This Warranty gives you specific legal rights, and you may also have other rights which vary from State to State. The Crusader California Emissions Warranty and California Emission Control Warranty Statement is a separate document included in this Manual. Any questions concerning the Emissions Warranty can be obtained by calling 1-586-977-0100.

L585003

Information below must be completely filled in to activate Warranty/Registration.

WARRANTY REGISTRATION CARD

IMPORTANT: The checks as listed below are required to insure the safety and satisfaction of you, the owner. By signing this form, the dealer certifies that he has checked the installation and operation of the engine(s) and finds them to be performing properly. The owner or his agent should perform similar inspections periodically to identify potential problems before they occur and have any suspected defects checked and/or corrected immediately.

Make Owner and Dealer copies of the Registration Card, as required. Mail original to Crusader Marine Engines.

(Please Type Information to Prevent a Processing Delay.)

Use Owner's Copy for Warranty ID until Warranty Identification Card is received by Owner.

Port - Engine Model # ____ Engine Serial #. ____ Transmission Model # ____ Transmission Serial # ____

Stbd - Engine Model # ____ Engine Serial #. ____ Transmission Model # ____ Transmission Serial # ____

Owner's Name ____

Address ____ City, State ____ Zip ____

Date of Sale ____ **Dealer Signature** ____

Selling Dealer ____ **PREMIER DEALER #** ____

Address ____ City, State ____ Zip ____

Pre-Delivery Checklist

- ☐ Check for Bulletins
- ☐ Belt and Pulley: Inspect for Damage
- ☐ Engine Oil: Check
- ☐ All Drain Plugs: Confirm Proper Installation
- ☐ Drive Lube: Check
- ☐ All Fuel Lines: Confirm No Leaks
- ☐ Battery Rating, Charge, and Level: Check
- ☐ All Oil Lines: Confirm No Leaks
- ☐ Control Adjustments: Confirm Proper Operation
- ☐ All Water Lines: Confirm No Leaks
- ☐ Gauges: Check for Proper Operation
- ☐ Electrical Wiring: Check for Proper Installation
- ☐ Record Propeller Size, Rotation and WOT - **Port**
  WOT RPM________Diameter________ Pitch________Rotation_________
- ☐ Record Propeller Size, Rotation and WOT - **Stbd**
  WOT RPM________Diameter________ Pitch________Rotation_________
- ☐ **Port** - Record Fuel Pressure, WOT ______
- ☐ **Starboard** - Record Fuel Pressure, WOT ______
- ☐ Dealer Reviewed Warranty with Owner
- ☐ Trouble Codes Checked Trouble Codes Cleared

Owner's Signature ____ Date ____

Boat Make ____ **Hull Serial #** ____ **Length** ____

Crusader Marine Engines PO Drawer 369 Little Mountain, SC 29075

From: ______________________________

____

____

FIRST
CLASS
POSTAGE

MAIL TO:

WARRANTY DEPARTMENT
CRUSADER MARINE ENGINES
P.O. DRAWER 369
LITTLE MOUNTAIN, SC 29075